VOLUME LVIII NUMBER TWO

THE NATIONAL GEOGRAPHIC MAGAZINE

AUGUST, 1930

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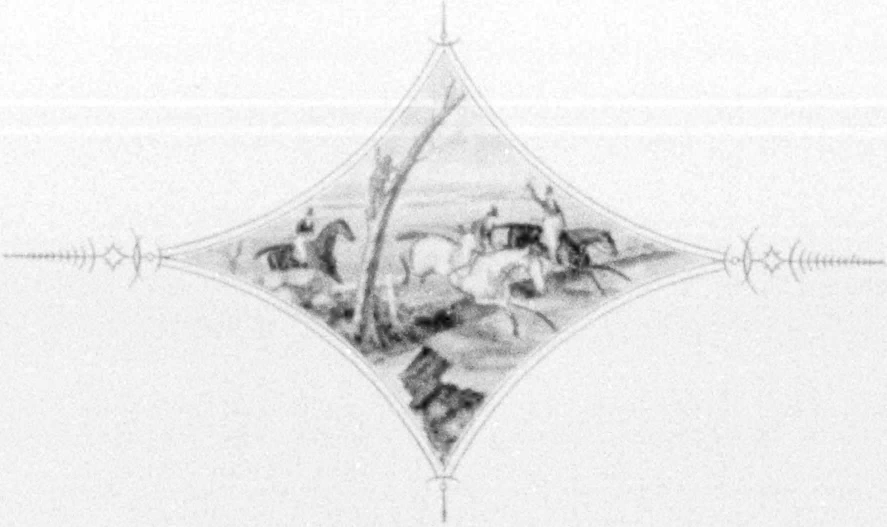

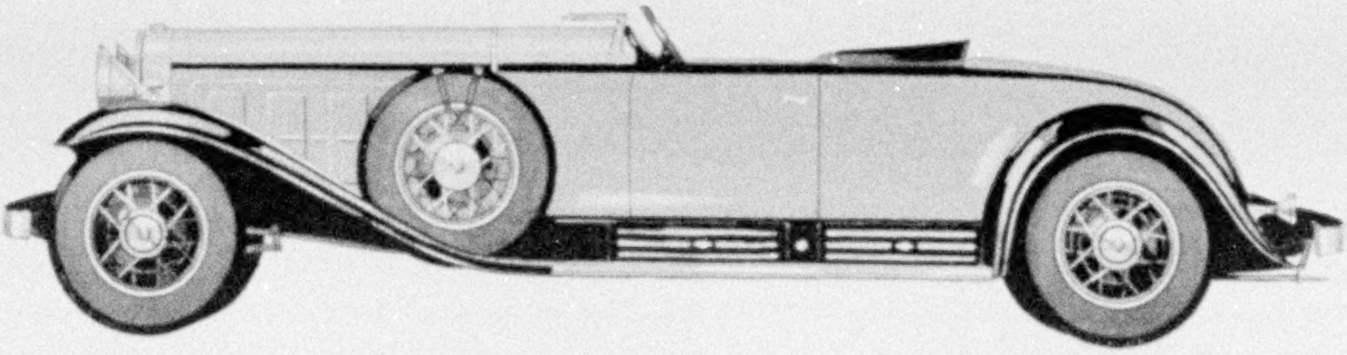

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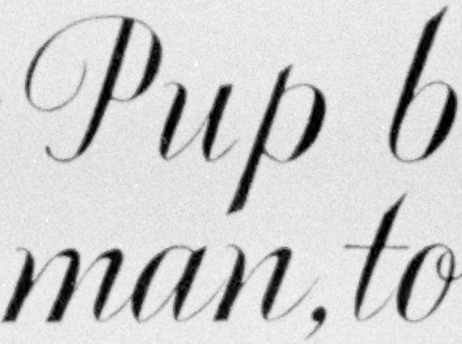

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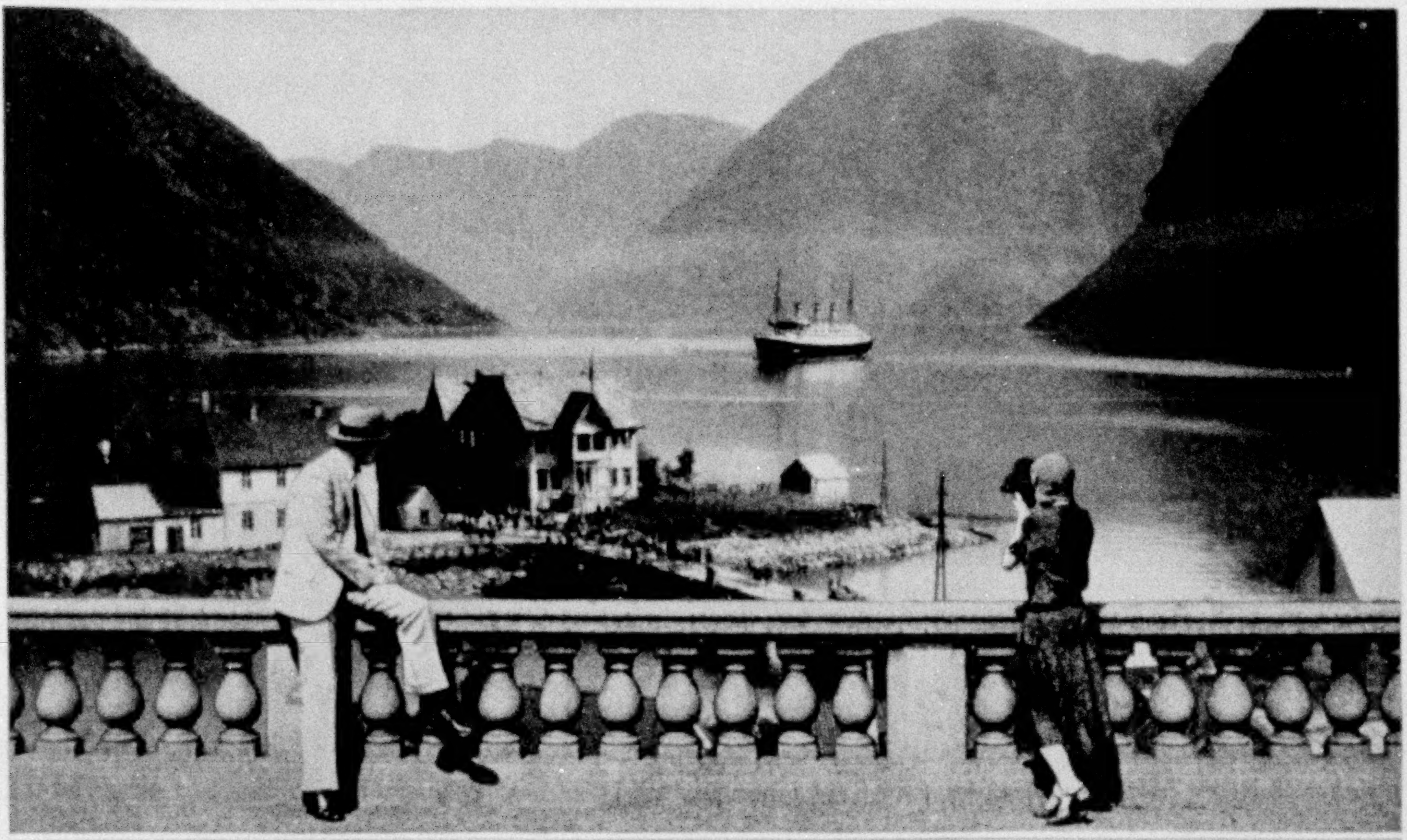

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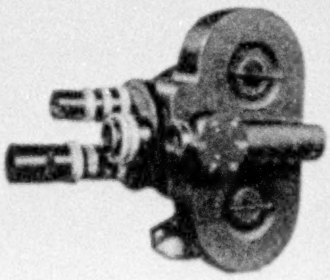

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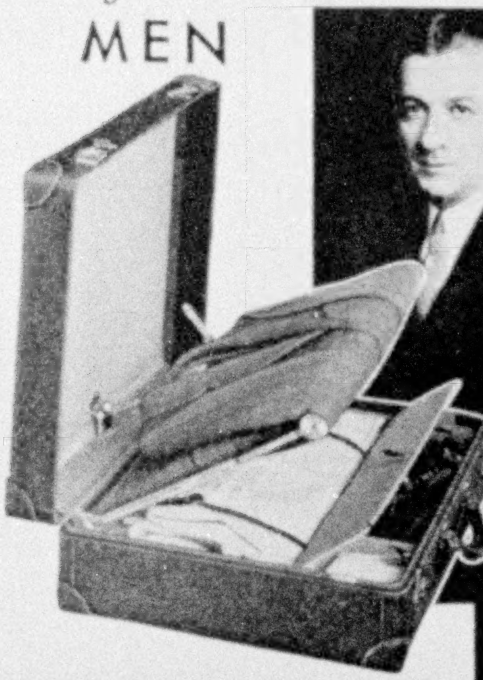

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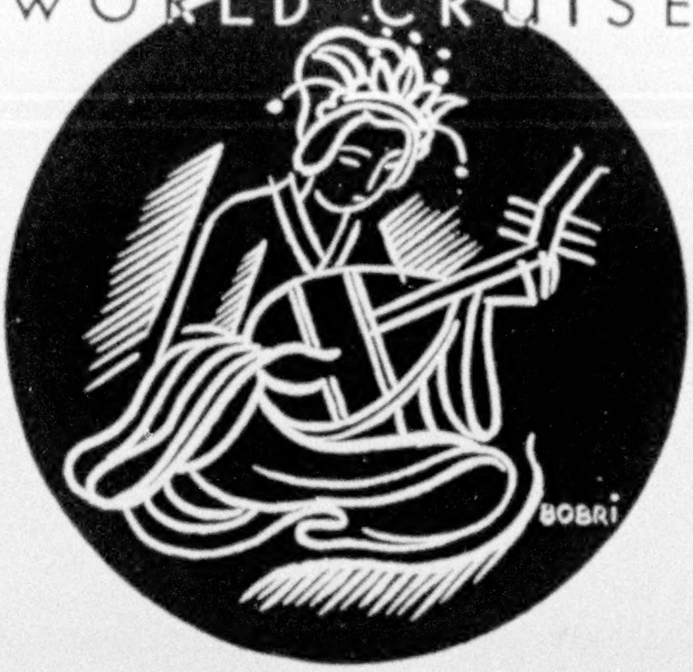

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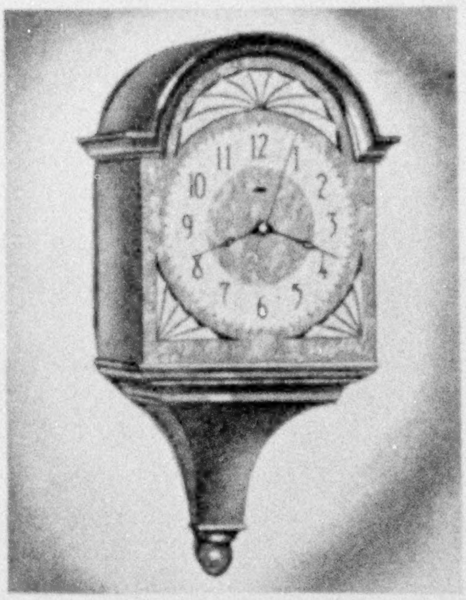

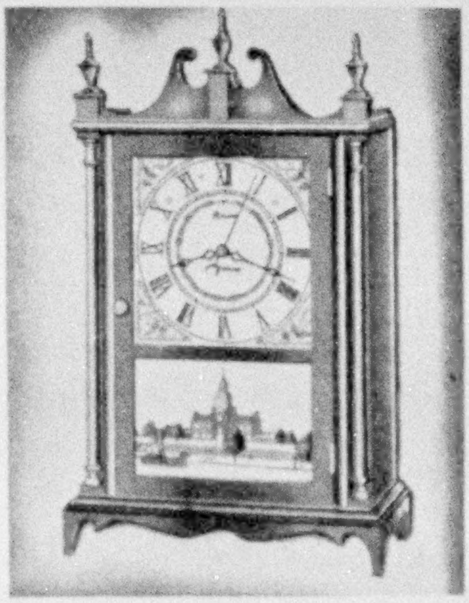

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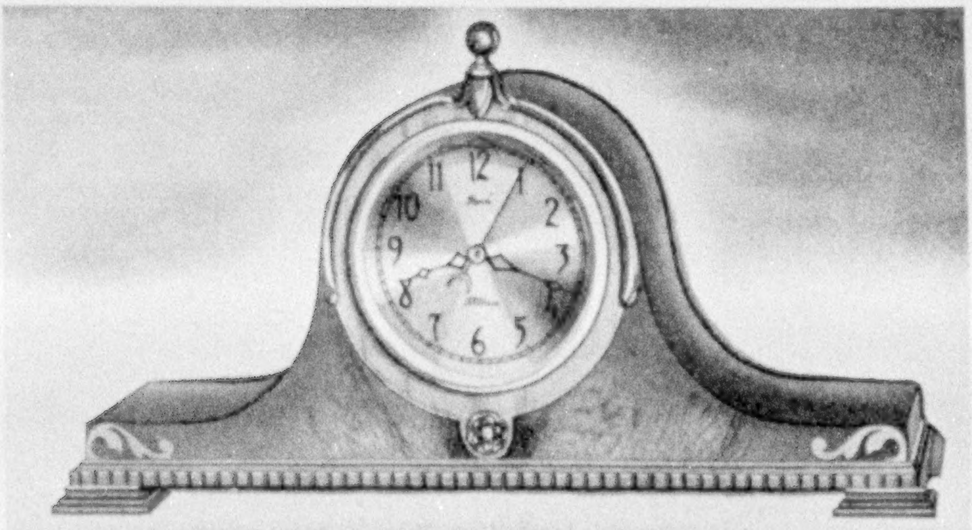

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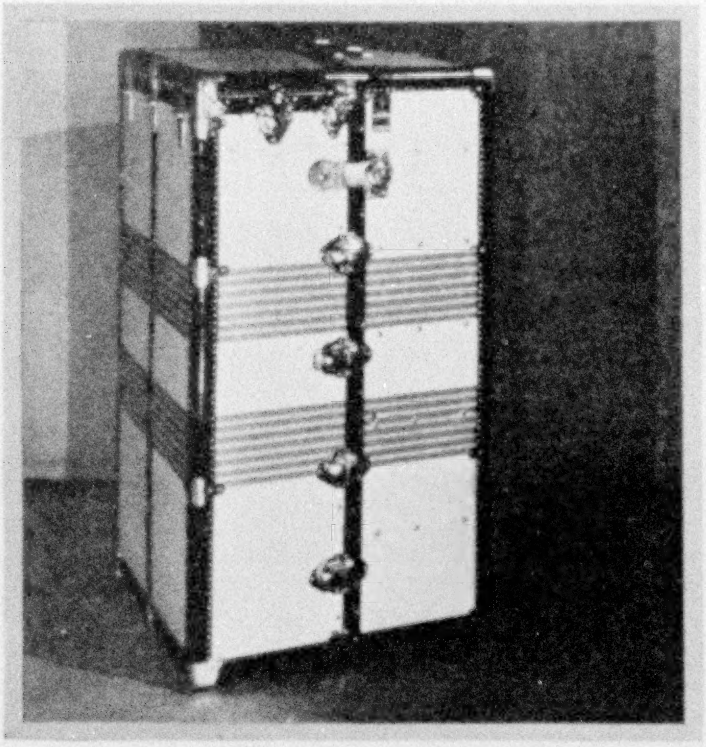

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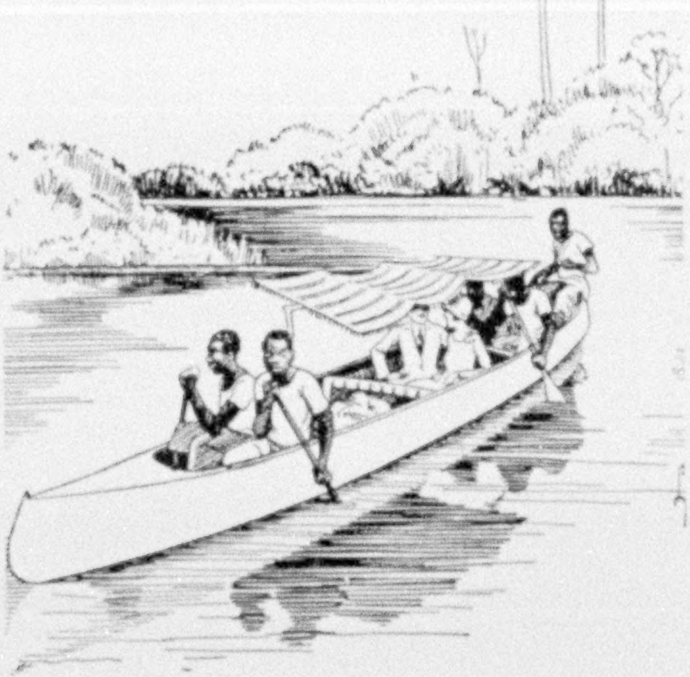

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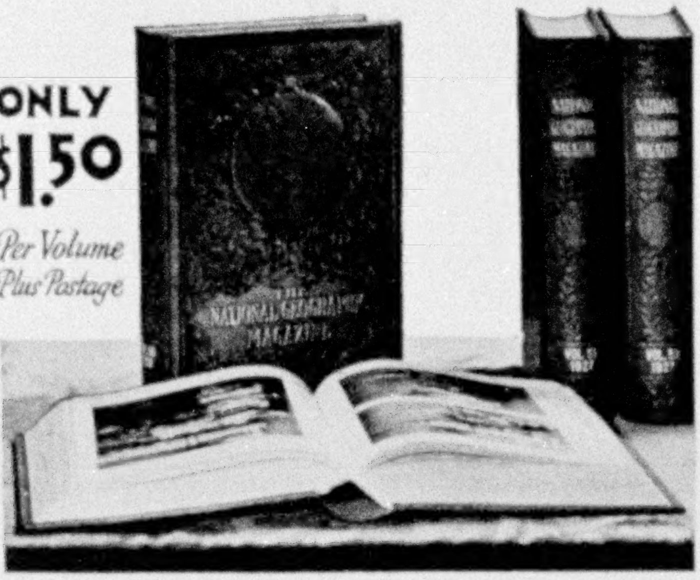

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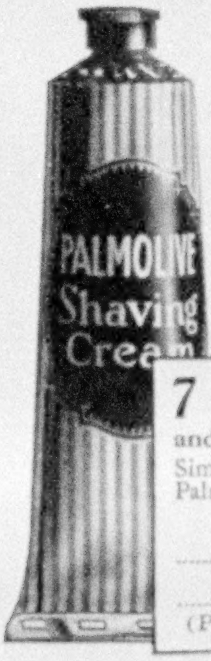

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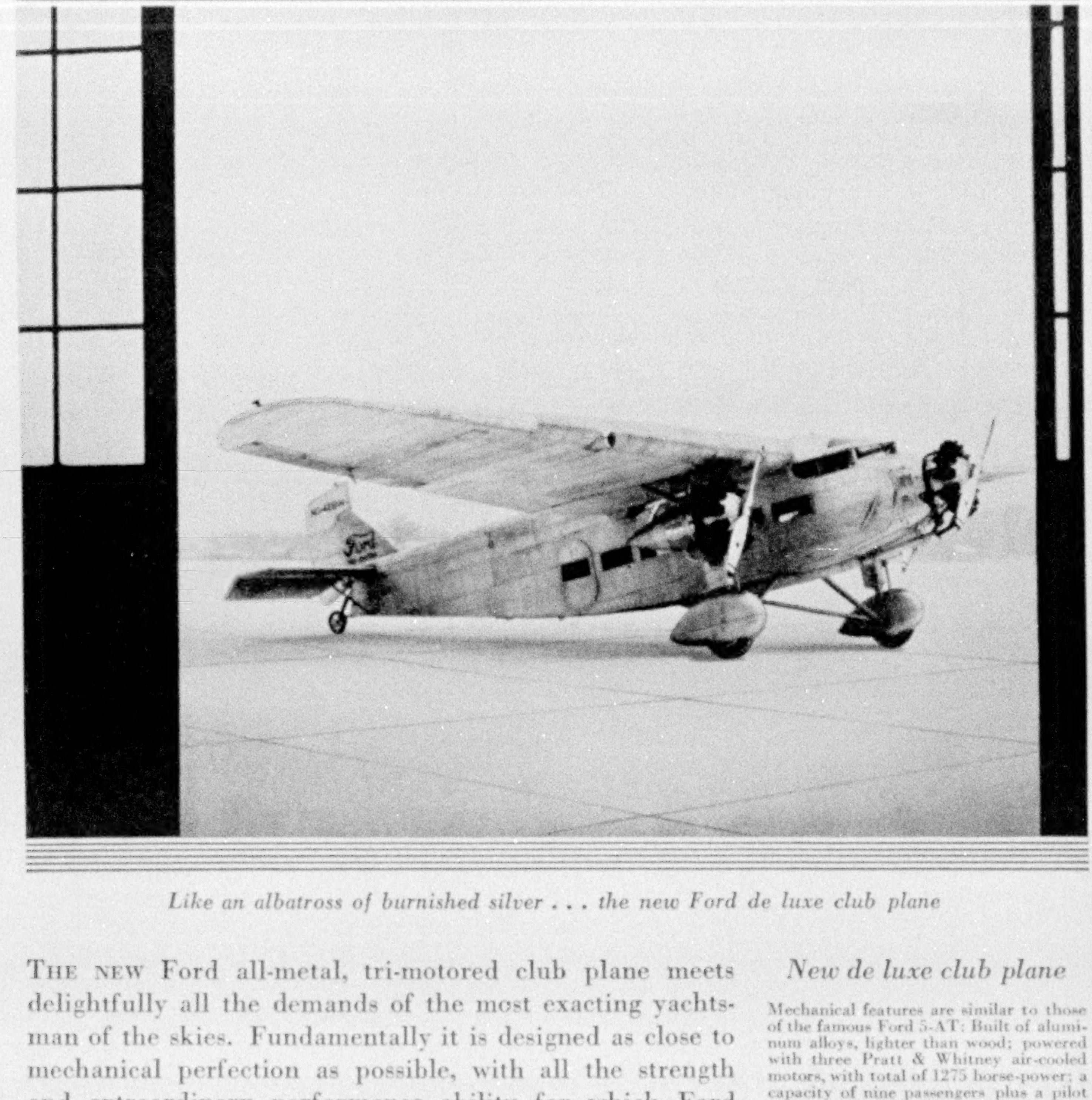

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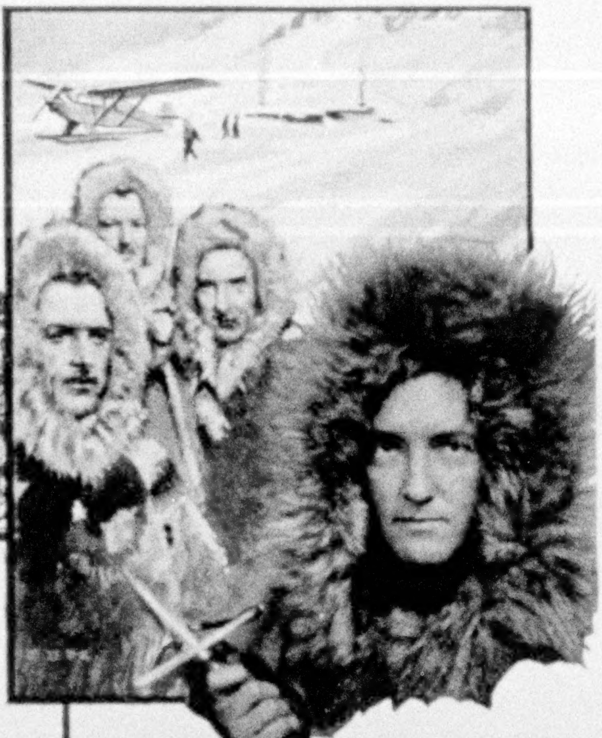

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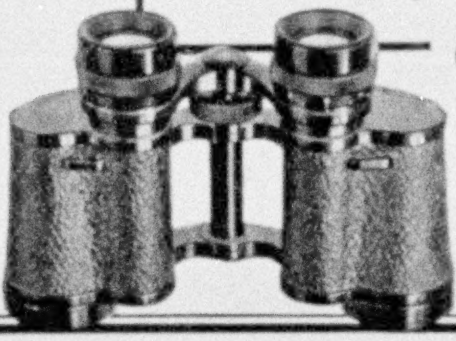

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Vol. LVIII, No. 2 WASHINGTON August, 1930

THE NATIONAL GEOGRAPHIC MAGAZINE

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THE CONQUEST OF ANTARCTICA BY AIR

By Richard Evelyn Byrd

Rear Admiral, U. S. Navy, Retired

Hubbard and Special Gold Medalist, National Geographic Society; Author of "The First Flight to the North Pole," "Our Transatlantic Flight," and "Flying Over the Arctic," in the National Geographic Magazine

EVER since Captain James Cook deduced the existence of a South Polar land mass from the icebergs and ocean currents of his farthest south voyage, 1772-5, the Antarctic Continent has remained the world's greatest geographic mystery. A whole continent of the planet we inhabit, an area of four and a half million square miles—even the area is an estimate—largely has resisted man's restless curiosity.

The expanse of territory of this continent is comparable to that of the United States and Mexico. Imagine these countries sheathed by the world's mightiest ice cap, its thickness unknown, its enormous peninsulas protruding far into the adjacent oceans, so that the meeting of underlying land and sea levels is obscured. Imagine the tremendous rim of this area partly belted by high ridges of almost impenetrable ice. Such, in its most characteristic features, is the aspect of this unique continent at the bottom of the world.

Two men have struggled afoot through vicious snows and winds, through the passes of a mountain range as high as parts of the Rockies, to reach the South Pole: one, the great, rugged Amundsen, came back to tell the tale; the other, the immortal Scott, and his companions perished in a "stabbing, blinding blizzard."

Explorers have from time to time approached other coastal points—notably Wilkes, just 90 years ago—the only other American to go there before us. A few have trudged inland a way, notably the indomitable Shackleton, each adding an iota to our scant knowledge of Antarctica.

RIDDLES OF ANTARCTICA

What a challenge to the explorer!

Is it a continent? Some geographers believe it is two huge islands. How far does its mountain chain extend, and is the chain linked with the New Zealand ridges or the mighty Andean range?

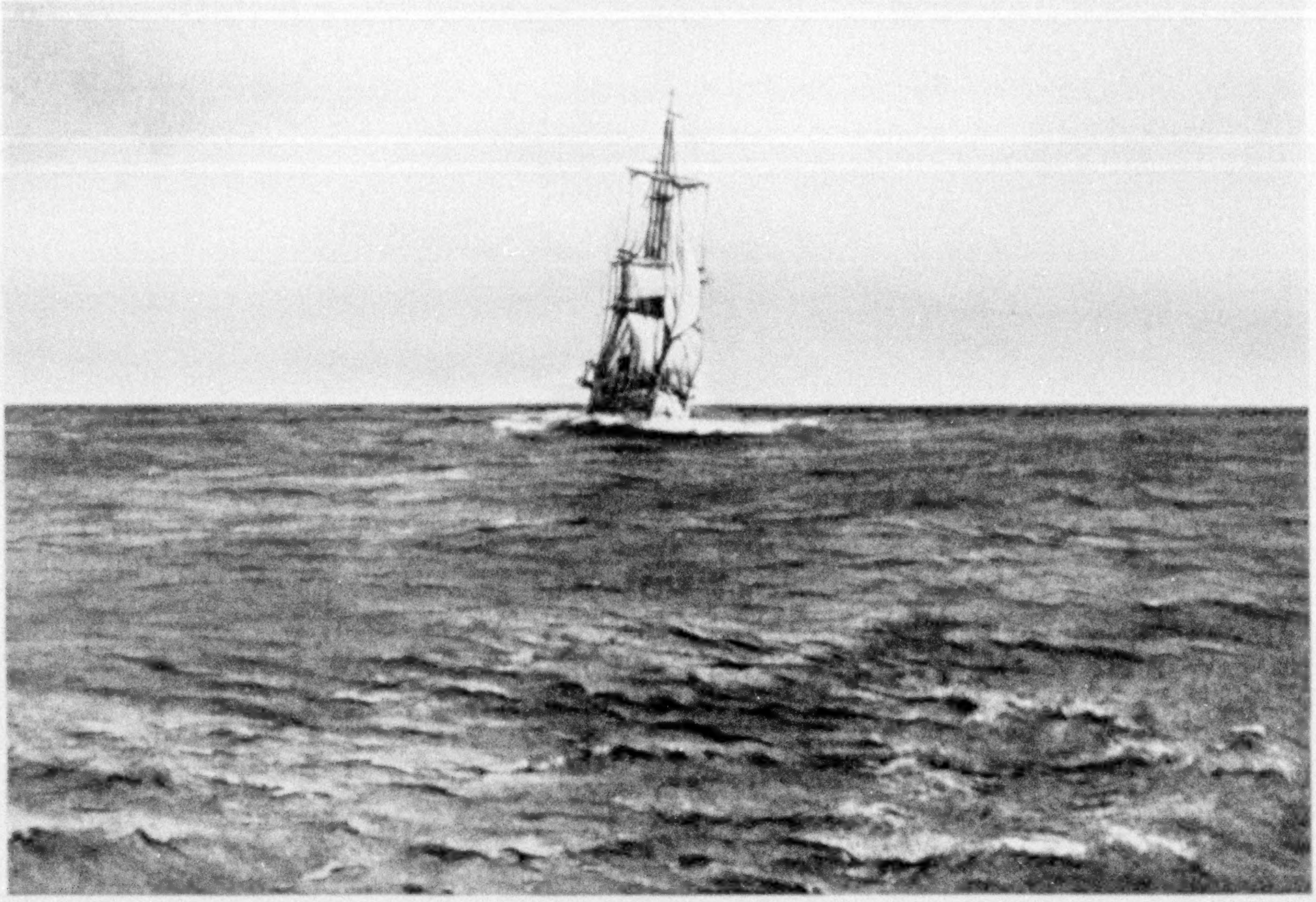
How thick is the ice cap? How old? How is it fed?

What of geology? Are there coal beds, minerals, fossils?

These are only a few of the questions we knew awaited solution. No single expedition might hope to answer them. But we could bring all the appurtenances of modern science to bear upon adding our contribution to the ultimate answers.

With our airplane, in a single flight, we saw more of the continent than all the previous explorers, necessarily land-bound, could possibly have beheld. And our mapping camera registered permanent, authentic, and complete records of what the human eye only had time to scan, as we sped through those chill skies at 100 miles an hour.

Of all we might find out, meteorological data, we realized, would be of highest im-



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THE "CITY OF NEW YORK," STURDY CARRIER OF 20TH-CENTURY ARGONAUTS

The staunch little vessel is no speed marvel, but she withstood the battering punishment of the Antarctic ice pack and brought Admiral Byrd and his fellow explorers safely home from their great adventure.

mediate value. South Polar regions affect the world's weather even more than do Arctic areas.

Therefore we asked the National Geographic Society, which already had generously contributed $25,000 toward our expedition and at a most critical subsequent time heartened us by radioing that an additional grant of $25,000 had been made, to assign us a meteorological expert.

FIELDS OF SCIENCE INVITING STUDY

For years I had read every record of Antarctic exploration and every scientific discussion of Antarctic problems. First, I determined the fields of science—geographical, geological, meteorological, glaciological, zoölogical, oceanographic, physics, radio, and so on—that called for study.

Then we sought the best specialists obtainable in these fields. Each man made an agenda of the scope of his work and the instruments he needed to carry on. The working program of each included scores of subject headings and would take two pages or more of THE GEOGRAPHIC to print.

We spent most time and thought on the scientific phases of our work. We were going for scientific exploration, and all our other plans were to keep us healthy and efficient while we were doing it, and, above all, to prevent the loss of lives. Our airplanes and our dog teams, also our radio, enabled us to get to places to make these studies.

We searched the world for the best ship, and located the stocky bark, which we renamed the *City of New York*, in Norway. Since 1885 this 512-ton vessel has been weathering rough seas and the Polar regions. Her hull is wedge-shaped, enabling her to rise when the ice clutches her in its tremendous pressure. It is reinforced with timbers 34 inches thick. I know of no other ship with sides that thick.

We carried full rigging to increase her steaming speed and also as life insurance, in case our coal should give out while battling with the ice.

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MAKING MOVIES UNDER DIFFICULTIES

Joe Rucker selected this precarious perch on the *City of New York* from which to take pictures while going through the ice pack. The motion-picture cameramen brought home 30 miles of film as their record of the expedition. The whaler *Larsen*, towing the *New York*, appears in the left background (see text, page 140).

On August 25, 1928, the *City of New York* wallowed down the choppy waters of the Hudson. It is not every day that a square-rigged ship puts out from New York harbor. Hundreds of craft, from the giant *Leviathan*, with its thunderous bass note, to motor launches, with their excited shrieks, whistled us their salutes.

Last-minute visitors kept wishing us well in the "work ahead of you." I must admit a feeling of relief at what lay behind—three years of the hardest work of my life.

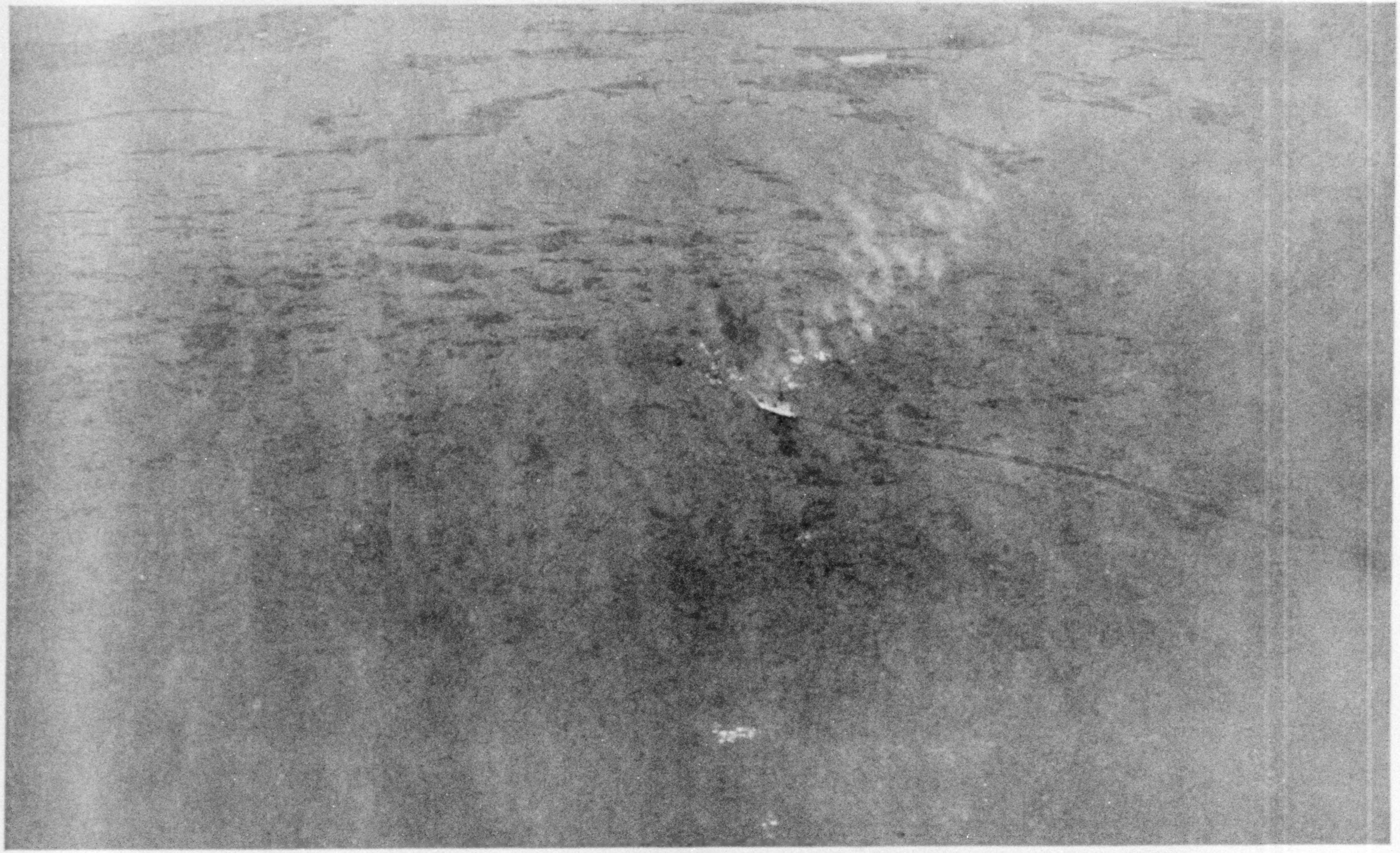
WINNING THE "BATTLE OF NEW YORK"

Three years, those were, of being alternately cartographer, dietitian, purchasing agent, fund-raiser, haberdasher, and jack of many other trades. Our success or failure would be most largely determined by the adequacy and foresight of our preparations.

The battle ahead in the unknown would lose or win according to the battle of preparation. The Battle of New York City we called it. There was little any one man could do. My companions rallied around me and put all they had into the fight. Charlie Lofgren, for example, was an anchor to windward then as he has been throughout the whole expedition. What gratitude to those fellows! What gratitude also to my other friends! Again and again the weight of our task carried us sliding down the rope that leads to failure, only at the bitter end to find the burden lightened by the grace of some friendly act. Though unnamed here, my friend, when you read these pages you will know that I have not forgotten you—that I can never forget you.

Clothing was one of numerous vital details that took days of thought, tests, and experiment. Clothes had to be warm, light, and roomy enough to permit perfect freedom, and windproof to protect us against the strongest and most piercing winds.

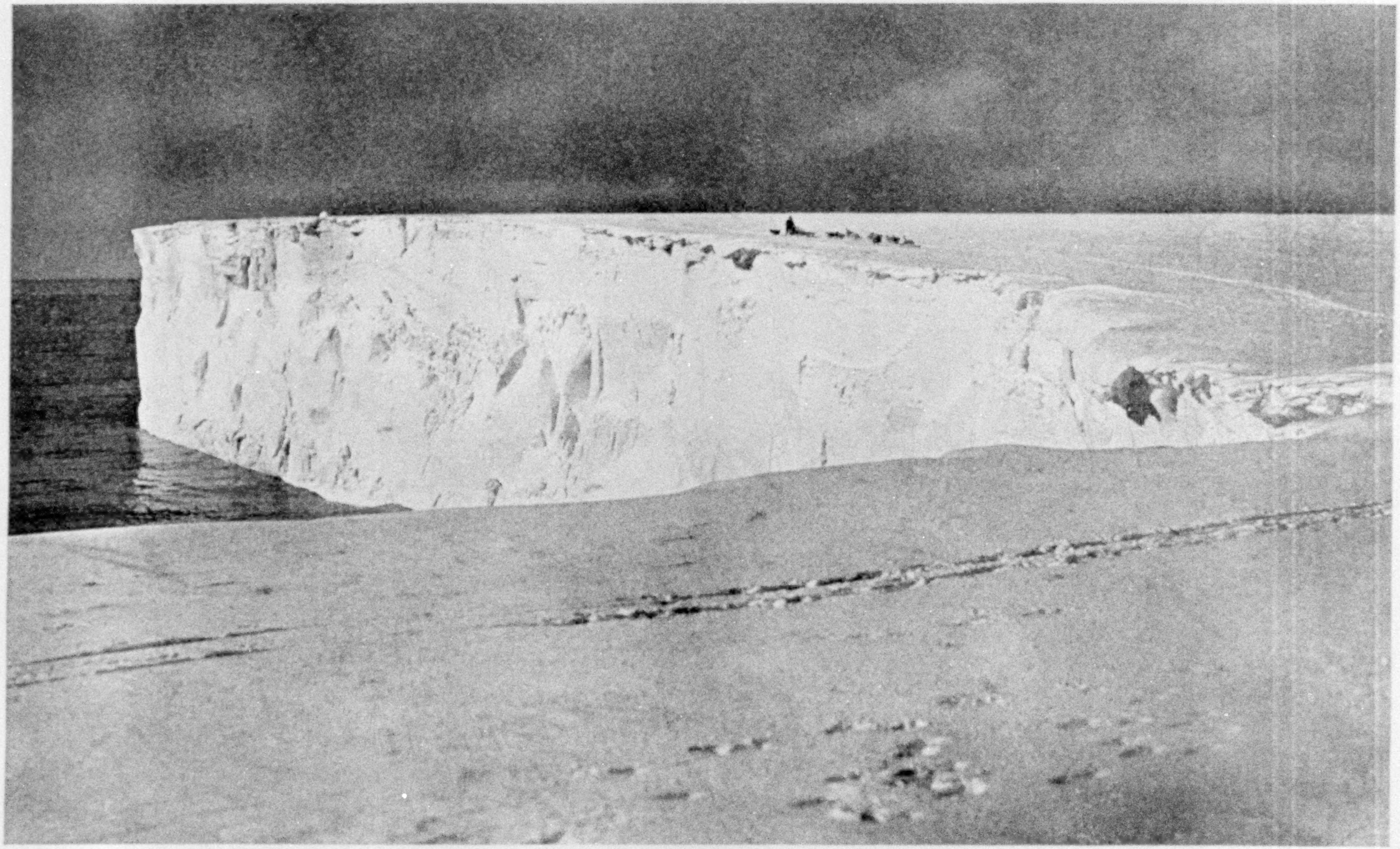
For very cold weather, and for rest, fur clothes are far preferable to any others.



© N. Y. T. & St. L. P. D. Aërial photograph by Capt. Ashley C. McKinley

THE "CITY OF NEW YORK" LEAVING ANTARCTICA

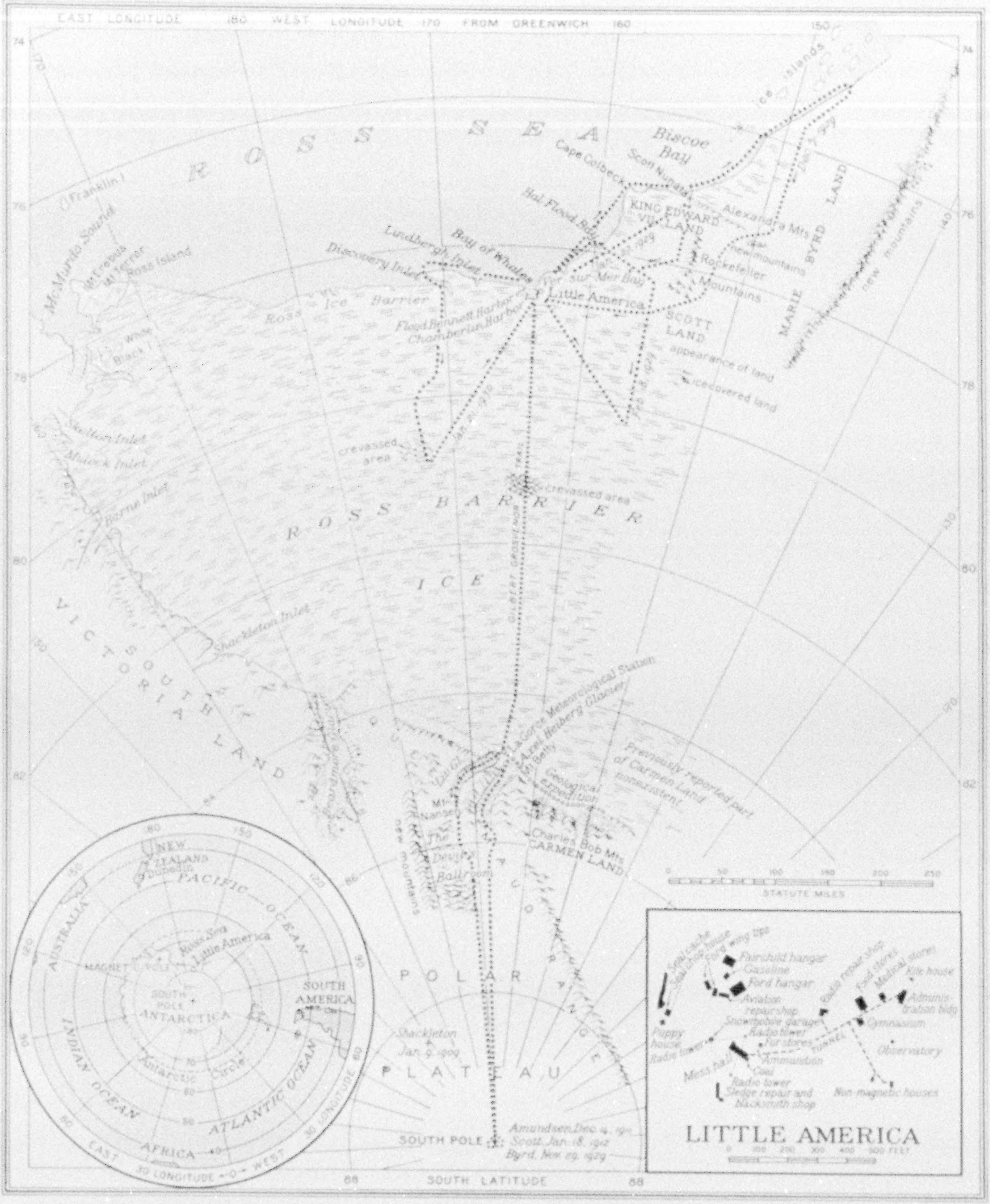
After landing the ice party safely at Little America, the flagship of the expedition returned to New Zealand and waited there until time to return and force a way through the ice pack to bring the explorers away.



Photograph courtesy Paramount Publix Corp.

FOR HUNDREDS OF MILES CLIFFS OF ICE AND SNOW FORM A BARRIER ABOUT THE ANTARCTIC CONTINENT

The dog team on top the barrier gives a measure of comparison for these towering ice walls.



Drawn by Albert H. Bumstead

ADMIRAL BYRD HAS MAPPED BY AËRIAL PHOTOGRAPHY 160,000 SQUARE MILES OF ANTARCTICA

Among the geographic achievements of the Byrd Antarctic Expedition during its 14-months stay in the South Polar regions were: the discovery of Marie Byrd Land, the discovery of important mountain ranges, the elimination of a large portion of Carmen Land, the charting of new inlets and bays of the Ross Ice Barrier, and the first conquest of the South Pole by air. The locations of various physiographic features on this map are approximate; a complete chart of Admiral Byrd's findings, with new nomenclature, will be published by the National Geographic Society as soon as his voluminous data can be incorporated on a large-scale map. At the lower left is an inset showing the relation of the Antarctic Continent to Australia, New Zealand, South America, and Africa; at the right, a detail of Little America, Antarctic headquarters of the expedition. The dotted lines show the principal airplane flights.

Admiral Peary always said the best clothes for Arctic wear are the skins of animals which live in the Arctic. He copied the clothes of the Eskimos around Etah, Greenland, the northernmost tribe in the world, and so did we. I studied their methods when I went up there in 1925 for the National Geographic Society.*

The lightest and warmest, and therefore most practical, kind of fur seems to be reindeer skin; so our mukluks (or boots), parkas (or coats), and many of our pants were made of reindeer skin. To give equal warmth, woolen clothes would have to be twice as heavy.

When moving on the trail in late spring, summer, or early fall, windproof over underclothes is sufficient to wear. I have a pair of polar-bear pants which I sometimes wear and find even warmer than reindeer skin, but they are heavier. Clothed in a large, roomy, reindeer-skin parka, with armpits large enough to bring the arms inside, polar-bear pants and reindeer-skin boots, one can sleep in the open without additional covering or tent in the coldest weather.

When on the trail, however, where exercise is most vigorous, furs are much too warm and in midsummer are needless. In bitter cold it is necessary to have them to wear at the end of the day's march. Wolverine is used around the parka hood and sleeves, since the moisture that freezes upon it can more readily be brushed off it than from any other fur.

Martin Ronne made all these clothes, and was kept busy during working hours the whole of the winter night. I doubt whether there is another man in the world who knows as much about cold-weather clothing as Ronne, or who would work more conscientiously or good-naturedly.

FOOTGEAR VITAL IN POLAR WORK

Footgear is perhaps the most important item of clothing. For the cold weather, the vital thing is to have footgear large enough. We used reindeer moccasins, rubber-soled lumberjack boots, and large ski boots, in addition to mukluks.

The bottoms of the mukluks were made of sealskin. Amundsen told me many times that it was almost impossible to get ski boots big enough. We had ours specially made, adequate for 70° below zero; but they were too big for summer use and in summer we had to cut these boots down and make entirely new ones. Mike Thorne made boots which gave excellent results.

Each man was provided with four suits of heavy underwear, ten pairs of socks, two pairs of breeches, six pairs of boots, two pairs of moccasins, two woolen shirts, two sweaters, one reindeer parka, one light parka, six pairs of mittens, dungarees, a muskrat cap and a reindeer skin or eider duck sleeping bag.

Contrary to general belief, the great problem in Antarctica arises, not from cold, but from the moisture. Moisture always forms and then freezes. That is why men lose feet and fingers, and that is why they have such a difficult time with sleeping bags. The whole camp, especially the trail parties, spent the entire winter working and experimenting with this problem. We licked it by doing such simple things as using sennagrass in the boots, windproof socks, pumping air regularly into the sleeping bags, and taking many extra pairs of socks and mittens, which could be dried when put out in certain conditions of weather.

WHAT THE EXPEDITION TOOK TO EAT

Anyone who has planned a month's camping trip away from civilization must appreciate the commissary problem of camping for a year in the world's largest nonshop area. Dr. Coman selected food with the proper fuel and vitamin value and estimated the daily needs and food consumption for each man, covered sheaves of paper with his calculations, then went out and bought:

Ham, two tons; bacon, three tons; beef, five tons; pork, two tons; lamb, one ton; chicken, one ton; turkey, 600 pounds; corned beef, two tons; salt pork, one and a half tons; corned shoulder, corned tongue, corned spareribs, pork sausage, two tons each; tinned butter, two tons; eggs, 500 cases; powdered milk, one ton; condensed, evaporated, and malted milk, 100 cases each; cookies, one thousand two hundred pounds; jams, jellies, and marmalade, one ton; flour, fifteen tons; lard, one ton.

Then there were: baking powder, 250 pounds; shaving soap, 1,200 sticks; talcum powder, 1,000 cans; hand soap, 8,840

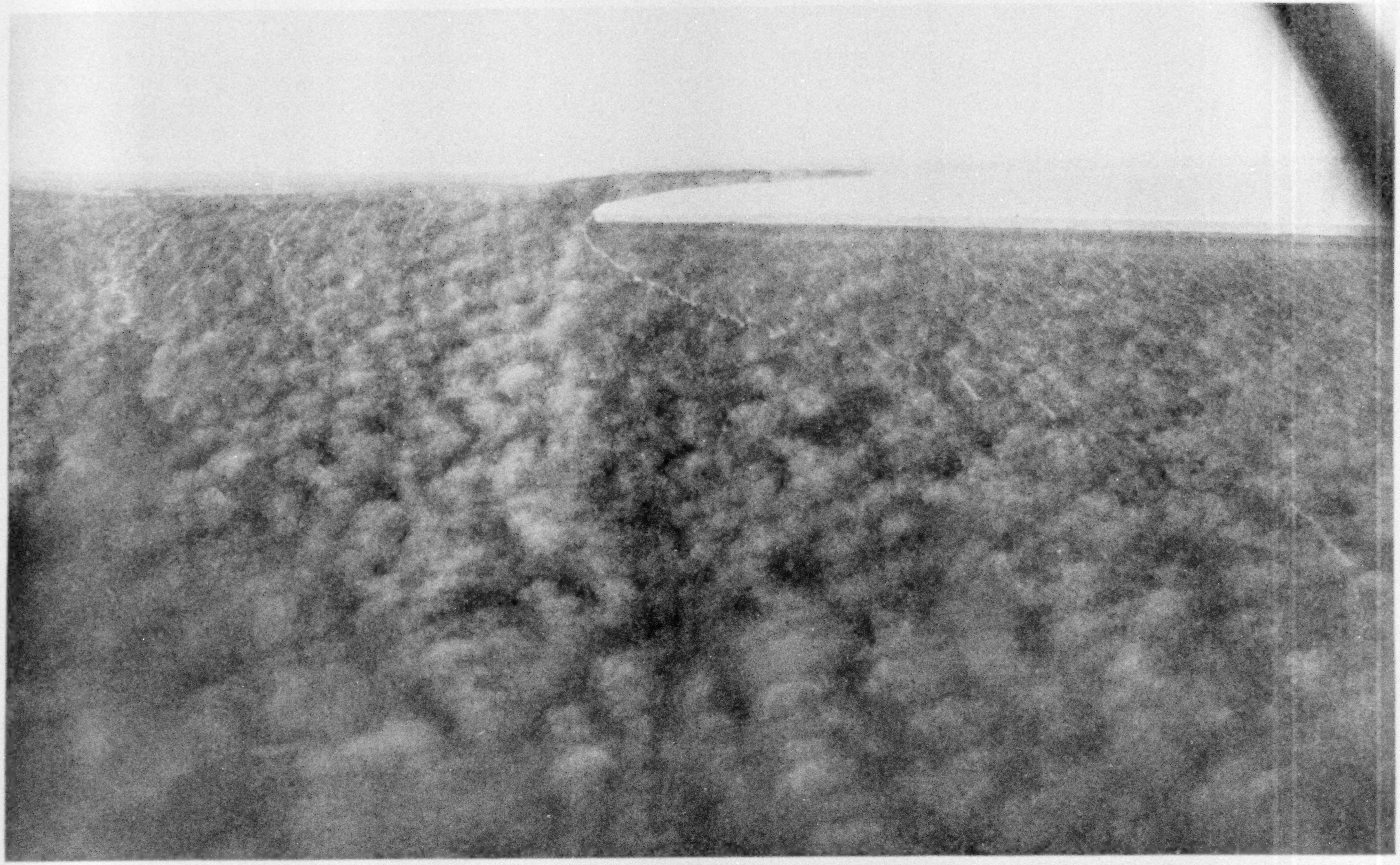
* See "Flying Over the Arctic," by Richard E. Byrd, in the NATIONAL GEOGRAPHIC MAGAZINE for November, 1925.

OVER ROUGH AND DANGEROUS PRESSURE ICE THE DOG TEAMS HAULED SUPPLIES FROM SHIP TO SHORE

Photographs © N. Y. T. & St. L. P. D.

MONARCH OF SOUTH POLAR SKIES

The big Ford monoplane, *Floyd Bennett*, performed superbly on its successful 1,600-mile round-trip flight to the South Pole, bearing Admiral Byrd, Bernt Balchen, Harold June, and Capt. Ashley McKinley.



© N. Y. T. & St. L. P. D. Aërial photograph by Capt. Ashley C. McKinley

SEA SMOKE HOVERS LIKE A DAPPLED SHROUD OVER ROSS SEA

This vapory substance stays close to the surface. When flying above it the airmen could not make out the decks of the *City of New York*, but could plainly see its masts sticking up above the "smoke." In the background is an ice tongue of the barrier, along the coast east of the Bay of Whales (see, also, illustration, page 181, and gravure plate X).

© N. Y. T. & St. L. P. D.

ADMIRAL BYRD'S "CAPITAL CITY" UNDER CONSTRUCTION

Little America was a metropolis compared to any Antarctic base which had preceded it. Forty-two men spent fourteen months there without critical illness or distress. It was equipped with improvised scientific laboratories, hospital, gymnasium, storerooms, mess hall, offices, machine shop, dog kennels, and radio station (see text, page 150). This photograph of the base camp was made before its completion and when some of the supplies were still stored in tents. The Adolph Ochs Radio Towers were named for the publisher of the *New York Times*.

cakes; face cream, 150 cans; 60 razors and 1,200 packets of blades; cereals, two and a quarter tons; coffee, two and three-quarters tons; tea, 375 pounds; cocoa, 600 pounds; dry codfish, 600 pounds; brown bread, 45 cases; assorted pickles, 1,200 gallons; kippered herring and herring and tomato sauce, 1,500 pounds each; candy, two and a half tons; American cheese, 1,250 pounds; dehydrated fruits and vegetables, four tons; dried fruits, five tons.

And here are some of the sundries on our list:

One ton of cooking utensils, one kitchen range, 60,000 sheets of writing paper, 800 bed sheets, 400 pillow cases, five folding bathtubs, two electric washing machines, twelve barrels of washing powder, table silver, thirty dozen toothbrushes, five dozen hand brushes, five dozen hair-brushes, and a number of folding cots and chairs.

We prepared for three years' stay instead of two, in case we should get caught down there another year.

Transportation needs in a continent where only the sledge and the pedestrian had traveled before us required months of planning and tests. We chose a tri-motored Ford, a single-motored Fairchild, and a single-motored Fokker, all monoplanes, to battle with the unknown flying conditions ahead of us. We took 80 huskies and Malemutes (Eskimo dogs) to transport our tons of equipment from the edge of the ice barrier to Little America and to enable the geological party to reach the mountains for scientific investigation. A snowmobile was carried to move supplies and equipment to our base.

A DEBT OF GRATITUDE TO NEW ZEALAND

Many of the supplies were shipped ahead to Dunedin, New Zealand, our final embarkation point for the south.

© N. Y. T. & St. L. P. D.

GAMES AND RADIO MUSIC HELPED TO PASS THE LEISURE HOURS

On Saturdays, at about 4 p. m. Antarctic time, Station KDKA or WGY broadcast special programs. Reception was excellent and the men of the ice party greatly enjoyed these performances. New Zealand stations came in well. The station at Little America was in daily code communication with the *New York Times* and once even held a "code conversation" with Greenland, at the other end of the earth (see, also, text, page 172).

We can never forget the helpfulness and hospitality of the people of New Zealand. At Wellington and at Dunedin, places hallowed by the memory of Scott, Shackleton, Amundsen, and Mawson, everything was done, officially and personally, to aid our project. We worked under the tension of knowing this was our "last chance" for preparation. When we left Dunedin, southern outpost of civilization, for the 2,300-mile voyage to Antarctica, we would write "finis" to all our preliminary prevision, which meant so much to our success.

When the winter night should set in, all the combined merchant marines and navies of the world could not reach us.

Just before we left we received the following telegram from the Prime Minister of New Zealand:

> On the eve of the departure of your expedition for the Antarctic, I desire on behalf of the Government and the people of New Zealand to extend to yourself, your officers, and the other members of the expedition, our cordial good wishes for the success of the undertaking. We sincerely trust that all will go well with you and your party, and that as a result of your exploration and research work the scientific world will be greatly enriched. New Zealand will gladly render you any assistance in its power, should the occasion arise. Best wishes to you all.

SHIPS PILED HIGH WITH CARGO

The day before the ships left, I was struck with the drama of the scene. All day long cranes dropped things on board the ships—planes and crates of foodstuffs, three houses, yelping dogs, sacks and bundles and boxes. The ship was down to the load line. Supplies kept pouring on. Back of the police lines 2,000 men, women, and children huddled, watching our men sweat and steam getting things aboard. The midship deck was loaded so high we had to reef the mainsail to set it. Below, we had to worm our way among the interstices of our cargo.

I remember that an old and serious-visaged man came up and grasped my

Photograph courtesy Paramount Publix Corp.

RADIO KEPT ALL EXPLORING PARTIES IN TOUCH WITH THE HOME BASE

Admiral Byrd's ability to communicate at all times with each unit of his expedition was a major factor in his success. The trail sets were made at Little America by the expedition's own engineers and gave extraordinary service. One annoyance experienced by radio users at home, but which never affected the expedition, was interference from other stations. A trail party is talking with Station WFA (Little America).

hand. "I've been down there," he said, pointing to the south, "and I don't think I'll see you fellows again. Your ship won't make it. Too heavily loaded."

This was not encouraging, and, besides, I knew that the dangers, despite his exaggeration, were real and menacing, especially from the stormy area we would have to pass through with our heavy loads. The ships did carry unusually heavy loads, but we had to take this chance. Coal was indispensable. All Antarctic expeditions have had to face the problem coal involves.

The vessels used for exploration down there are too small to allow a normally safe surplus of cruising radius. For one thing, there are no larger vessels that can withstand the ice pressure. If they were available, indigent explorers could not very well afford to charter them. And we were forced to carry enough coal not only for the 4,700-mile round trip between the Bay of Whales and Dunedin, but also an additional 75 tons to be deposited at our base.

THE FIRST ANTARCTIC STORM

The *New York* and the *Eleanor Bolling* set sail from Dunedin at 6 o'clock on the morning of December 2, 1928. We had a perfect day at sea, with no wind; only heavy swells from a gale of the day before.

When the wind was right, the *New York* plowed through the heavy swell under sail and steam at seven knots.

© N. Y. T. & St. L. P. D.

CLOUD FORMATIONS SOMETIMES RIVAL THE ICE AND SNOW FOR FANTASTIC BEAUTY

The view shows Little America's flying field with a familiar type of wind-direction indicator.

Other days the *Eleanor Bolling* towed, and it was tricky work keeping a sailing ship under full sail in tow of a steamship. Frequently only quick jockeying kept the vessels in line. We realized the value of radio when we talked from ship to ship by wireless telephone, sent daily dispatches of our progress to the *New York Times*, and received a daily press report of the home news.

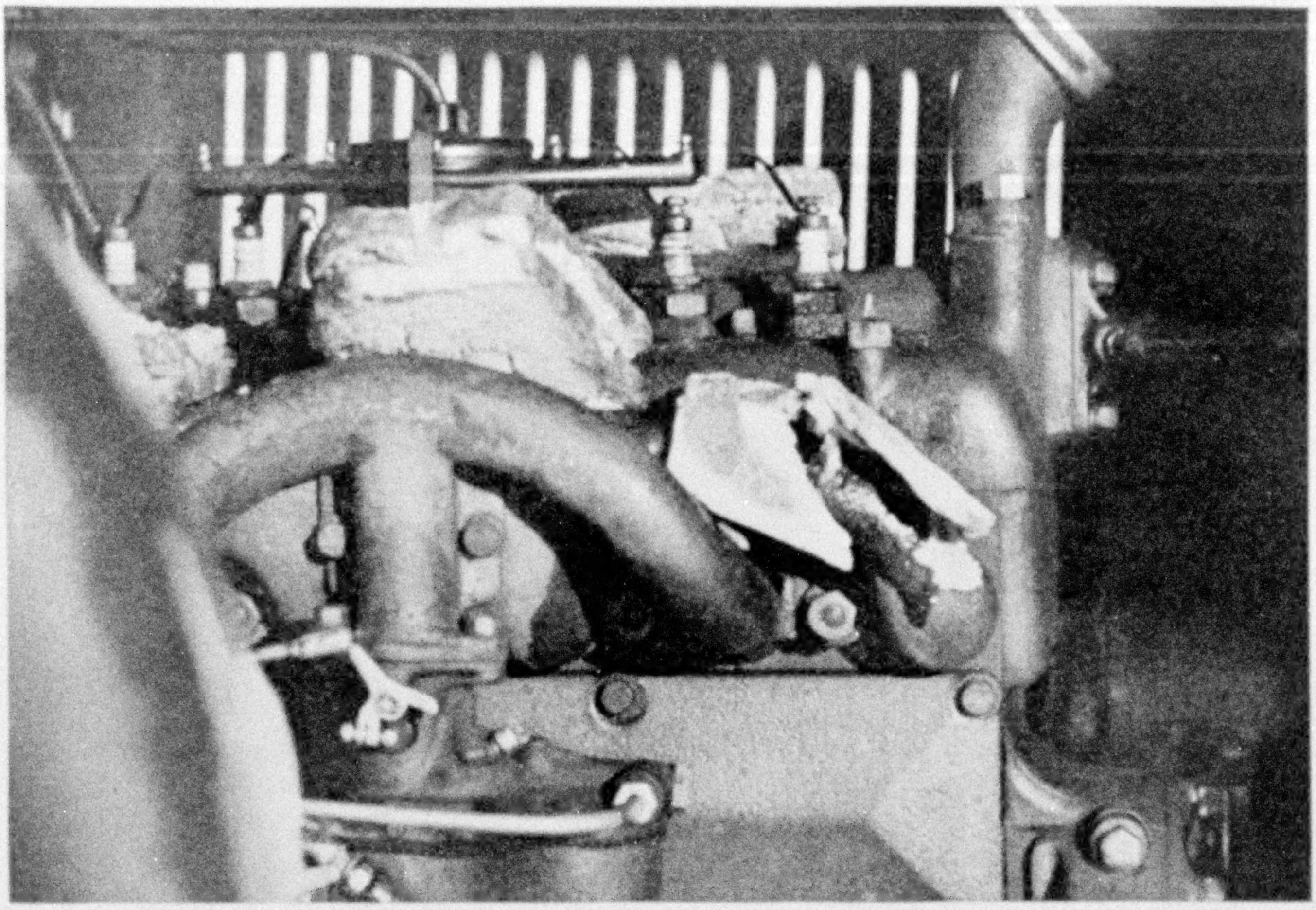
On December 6 we had our first taste of an Antarctic storm. That night and next day we ran before a gale under fore and main topsails. The men worked like beavers making fast the mounds of supplies; below, they crawled, crabwise, over barrels and crates. Going to meals was an adventure, because the deck was so loaded that the only way to get forward to the fo'c's'le was along the rail, clinging to ropes and boards.

Aloft, the lookout for bergs and ice cakes had a dizzy time, for as the staunch ship would lie over to port, then swing back again, the tall spars cut wide and dizzy arcs. But we were fortunate. Other explorers had lost valuable equipment in the stormy area.

On our first December 10—the date repeated because we crossed the 180th meridian—we ran among giant icebergs in a snowstorm. Next day, still December 10, we sighted Scott Island, the "lost" island, because other ships had passed over the place where it was supposed to be and failed to see it.

FACING THE ICE PACK AROUND ROSS SEA

In three days we faced the ice pack that encircles the Ross Sea. East and west, as far as we could see, the ice extended in an unbroken line of white.



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THAWING OUT A HAM-AND-EGG SANDWICH

On the ill-fated snowmobile trip (see, also, page 190), the sandwiches, which had been taken along for the first day's lunch, froze so hard that the men's teeth could make no impression on them. They tried thawing them out on the machine's motor, but the resultant flavor of gasoline did not prove popular.

Fortunately, we had two days of calm, so our crews were able to shift 87 tons of coal from the *Eleanor Bolling's* hold to the *City of New York*, after which the former steamed back to New Zealand for more coal, leaving us to be towed by the big whaler, *C. A. Larsen*, the ship which had brought some of my men and me from California to New Zealand.

We were attempting a really delicate and dangerous experiment—dangerous in the sense that the threat of collision when we struck the green ice must call for unrelaxing vigilance. However, if the towing succeeded, we could hope to reach the Bay of Whales perhaps a month earlier than other expeditions had managed to do.

This gain in time was vitally important to our plans. As it turned out, without it we might have failed in large measure, for the ice in the Bay of Whales that year was ten miles farther out than Amundsen had found it, and the job of landing our immense cargo of supplies and our airplanes was scarcely finished before winter came.

December 14, the anniversary of Amundsen's arrival at the South Pole in 1911, we started through the ice pack at a point 700 miles distant from the Bay of Whales.

The sky of pale, Arctic blue, tinged with gray toward the horizon; the interminable monotony of the ice, eroded in grotesque shapes, broken by the open leads through which we were sailing; occasional fat, sleepy seals basking in the sun, and Antarctic birds winging swiftly in silent flight—all gave a false sense of serenity. Then a crash and the ship would tremble like a living thing.

To this was added the menace of collision. Time and time again, as the *Larsen* stubbed her 17,000 tons against submerged ice, the *New York*, trailing behind, was barely prevented from crashing into her stern. To guard against this, we had to mount special watches.

In this fantastic world we had a snowstorm. It curtained our frozen world beyond a radius of fifty yards from the ship. Suddenly, toward midnight, the clouds

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LUNCHING AL FRESCO ON THE BAY ICE

When the members of the photographic party stopped here for refreshment—bean soup and pemmican—the ice was breaking up under the influence of spring weather. The boat was taken along in case the ice on which they were camping should break off and leave open water between them and camp. The man in the center is melting snow for drinking water.

broke, and for two hours the sun painted strips of rose color and pastel shades on the infinite variety of ice sculpture around us. Then the snowfall began again, a high wind drove sheets of it across our ship, and we lay to. Leads might open ahead, but we were just as likely to crash into a floating sheet of ice.

A RECORD RADIO MESSAGE

While we lingered in these ice fields we received a message of Captain Sir Hubert Wilkins's flight over Graham Land. We had the news sooner than the public at home, who had to wait for the morning papers, because it was flashed immediately from the *New York Times* short-wave station WHD to our station WFBT, 9,200 miles distant. I wrote my congratulations to Sir Hubert, and the electrical impulse flashed them back to New York. They were land-wired to San Francisco, and then wirelessed across a 7,700-mile gap to the Wilkins base at Deception Island. Thus, in a few hours, we had crisscrossed messages along 39,000 miles, including Wilkins's original announcement—truly a marvelous demonstration of modern communication!

For 7½ days we bumped along, ramming the pack, pushing the cakes aside, backing and jamming forward again. The big whaler, with its powerful engines, forced aside ice which the *City of New York* could not have bucked, even though we could have withstood a squeeze from the ice, which might have crushed the *Larsen* as if it were an eggshell. However, the summer ice afforded enough leads for the *Larsen* to get through, and by means of her great power and skillful maneuvering she was able to avoid a bad squeeze whenever one threatened.

We had been towed 1,800 miles by the *Eleanor Bolling* and the *C. A. Larsen;* so that, when the whaler left us, December 23, we had plenty of coal for our lonely trip to the ice barrier. Besides, the *Bolling* would supply the *New York* with more coal when she reached the barrier. That is how we overcame this very troublesome problem.

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LITTLE AMERICANS DEVELOPED ALL KINDS OF BEARDS EXCEPT BLUEBEARDS

Subzero temperatures are not conducive to shaving, and facial adornment changed the appearance of many of Admiral Byrd's men. As they appear from left to right: Tennant, Hanson, Parker, Smith, June, and Rucker, some of whom might be masquerading as Oom Paul Kruger, Trotsky, General Grant, and Abraham Lincoln.

Our last day in the ice pack was the hardest. We maneuvered incessantly, but we had some violent collisions. Once, sidling up to a huge floe, we scraped along, trying to round its jagged corner, and the protruding ice nearly carried off our ice boat.

We emerged from the bumping, crunching, restless pack suddenly—so suddenly it took us by surprise—into Ross Sea, which lay before us; it was at the moment as smooth and calm as Long Island Sound. It had been obscured by a peculiar alignment of bergs, small "table bergs," with flat tops, rising out of the water about 30 feet, extending as far as the eye could see.

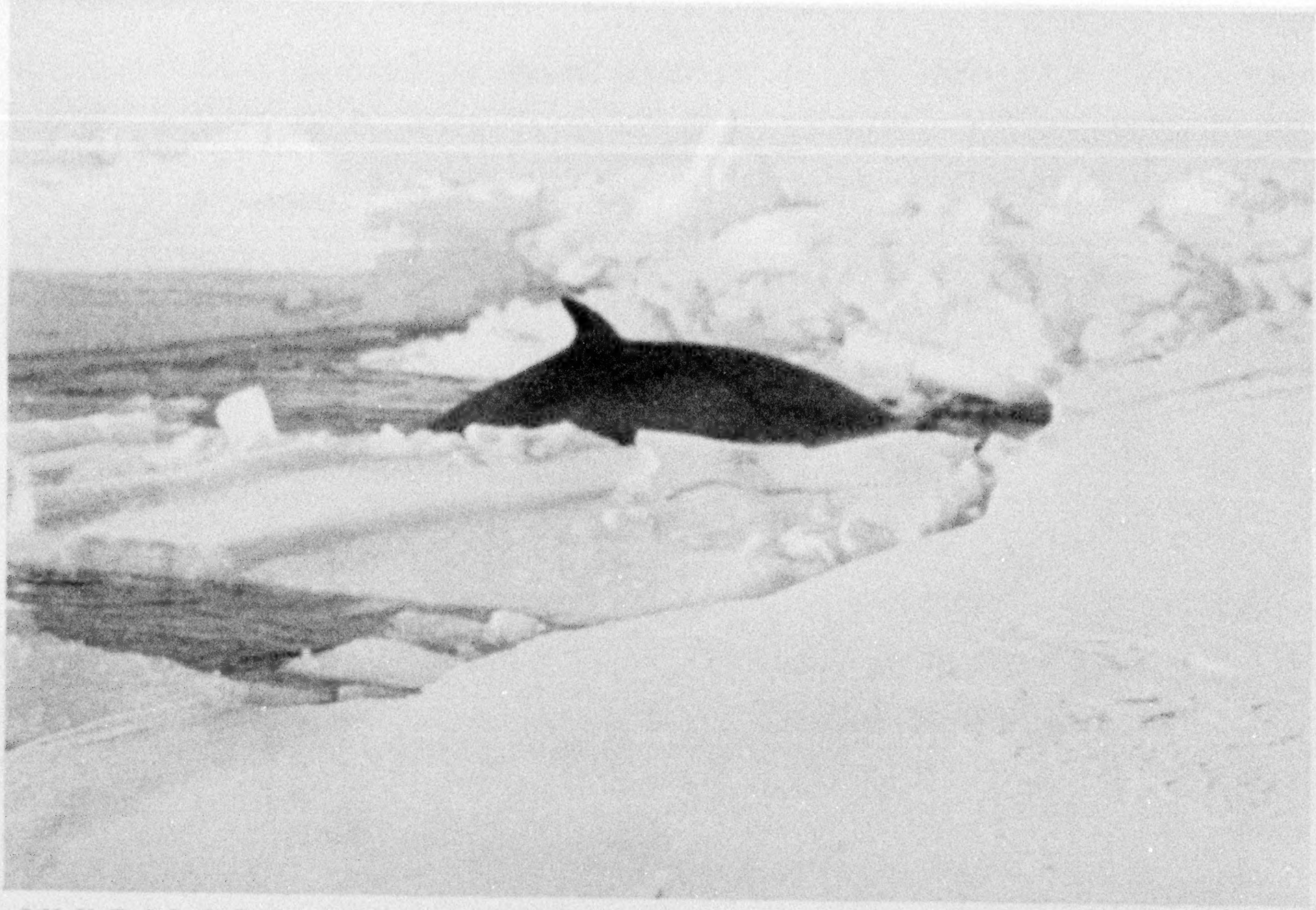
Captain Nilsen, of the *C. A. Larsen*, came aboard to bid us farewell. He is a fine sportsman and a staunch friend. He gave us much good advice and a lot of whale meat. His service to the expedition and that of Mr. Konow, the manager, were incalculable.

"Pass the whale" soon ceased to be a joke at mess. The men liked it best cut thin and fried or chopped with onions in meat balls. The meat of some of the old whales was, I must confess, a trifle strong. Some weighed 180,000 pounds. One could hardly expect the meat of such a colossal creature to be delicate.

THE BARRIER IS REACHED CHRISTMAS DAY

On Christmas Day, 1928, we were at the barrier. The sheer ice cliffs, which seemed a symbol of this impregnable continent, towered in places higher than the masts of our ships. Here, at last, was the vast, unique sheet of ice and snow that is peculiar to Antarctica. We were to live on it. Would we be able to solve any of the mysteries that it then presented?

We sighted it just after our Christmas celebration in the forecastle. Some of us were coming on deck when Sverre Strom, the mate, called, "Barrier on the starboard



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THIS LITTLE "PIG WHALE" STRAYED TOO FAR

Following a lead, he swam into close quarters and was unable to return to open water because the shifting bay ice had closed in behind him. He had then to wait for the ice to shift again or take a chance on swimming under it and finding a way out. This latter procedure would be dangerous, for a whale of this type can stay submerged only from seven to ten minutes.

bow!" The men released their long-pent energies in yells and cheers. I radioed to the Secretary of the Navy:

> On this Christmas Day we are thankful and proud to report that we have been able to carry the American flag several hundred miles farther south than it has ever been, and it seems fitting that an airplane, that instrument of good-will, should reach its farthest south on Christmas Day.
>
> We are 2,300 statute miles from the nearest human dwelling, in the only area in the world where a ship can get so far from civilization.

There was little sleep that night. We believed our first goal had been attained, and we listened to the Christmas-night program broadcast to us from KDKA. That broadcast set a new record for distance transmission of a vocal program by radio. Meanwhile, on another wave-length personal Christmas greetings for the men were sent by code from New York, 9,200 miles away.

We had approached the 500-mile ice wall at longitude about 177 west, and we cruised along it Christmas night and the next morning. Our physicist and topographer made sketches. We gazed at it with awe. It rose from 40 to 90 feet—majestic, forbidding, clean-cut where huge bergs had broken off. Cliffs overhung caves where waves had worn away the wall at the water line. We took soundings that showed depths of 250 to 300 fathoms at one to three miles out.

"THE FIRST TO LAND"

In the afternoon we went ashore at Discovery Inlet, if one may call a floating ice sheet a shore.

There was a scramble to be first over the side. Capt. Alton Parker, of the Marine Corps, won and yelled back, "The Marines are always the first to land."

Our visit to Discovery Harbor was worth while. We found the ice-locked harbor differed in material details from the outlines previously charted. It may easily be that there has been a change in its contour. Instead of running east

Photograph courtesy Paramount Publix Corp.

DR. COMAN CONDUCTED A BABY CLINIC FOR WEDDELL SEALS

Assisted by Paul Siple, Boy Scout member of the expedition (left), the medical officer weighed, measured, and tagged numerous seal pups and carefully recorded their growth and habits. This was probably the first "baby clinic" held in Antarctica.

and west, as it appears on the charts, there is a general curve from eastward toward the south; so that at the harbor's end, where the lines of the ice barrier meet, its direction is nearly north and south. We later surveyed it from the air (see sketch map, page 132).

At one point the barrier sloped gently down to the bay ice, so that we could climb onto the barrier, which we ascended for 150 feet. The barrier is snow until it reaches the water, where it becomes green ice, which probably extends several hundred feet below the surface. Though we got soundings of more than 1,000 feet in Discovery Bay, I believe the ice must somewhere rest on the bottom. I cannot otherwise account for the fact that the points of the bay do not break off and float away in the shape of icebergs.

We sailed on to the Bay of Whales, arriving there in Arctic midsummer, and found that surprisingly little of the ice had gone out.

At last we had reached that interesting place that had been so long in our minds—the mysterious ice-locked bay where a ship can get nearer the South Pole than at any other known place in the world. There was no land in sight.

The date was December 28, more than two weeks earlier than Amundsen had arrived, at which time the edge of the ice was at least ten miles farther south. The Bay of Whales is about twenty miles wide from West Cape to East Cape, and about the same in length.

The shore line of the bay, if such it can be called, was formed by the barrier walls, and the bay itself was filled with bay ice which was only a few feet thick as compared to the several-hundred-foot thickness of the barrier.

TO WAIT OR NOT TO WAIT—A PROBLEM

A serious problem, involving a grave decision, confronted us. During Amundsen's second year, as in his first, many miles more of the ice in the bay had gone out than was the case when we arrived. Was this due to the fact that we had arrived so early in the season? Should we

Photograph courtesy Paramount Publix Corp.

MRS. SEAL LOOKS ON WHILE HER OFFSPRING IS EXAMINED

The pups offered no resistance save a few feeble growls, and while the mother was evidently not in accord with this child-welfare movement, her objections, too, were purely vocal.

wait for the ice to go out, or should we begin at once hauling our tons of supplies to our base?

We realized that using dog teams on the bay ice would be hazardous work, for the surface was bound to break up more or less. In fact, within the first few hours of our arrival we had to shift berth several times on that account. With this breaking process going on, we would have to exercise utmost caution to prevent loss of life. I know of many cases of men drifting out to sea on ice floes. There was also the risk of losing teams and drivers down the cracks and in the pressure ridges.

Before making the decision to risk the bay ice, it seemed wise to select a suitable and reasonably safe base on the barrier, as near the edge as possible.

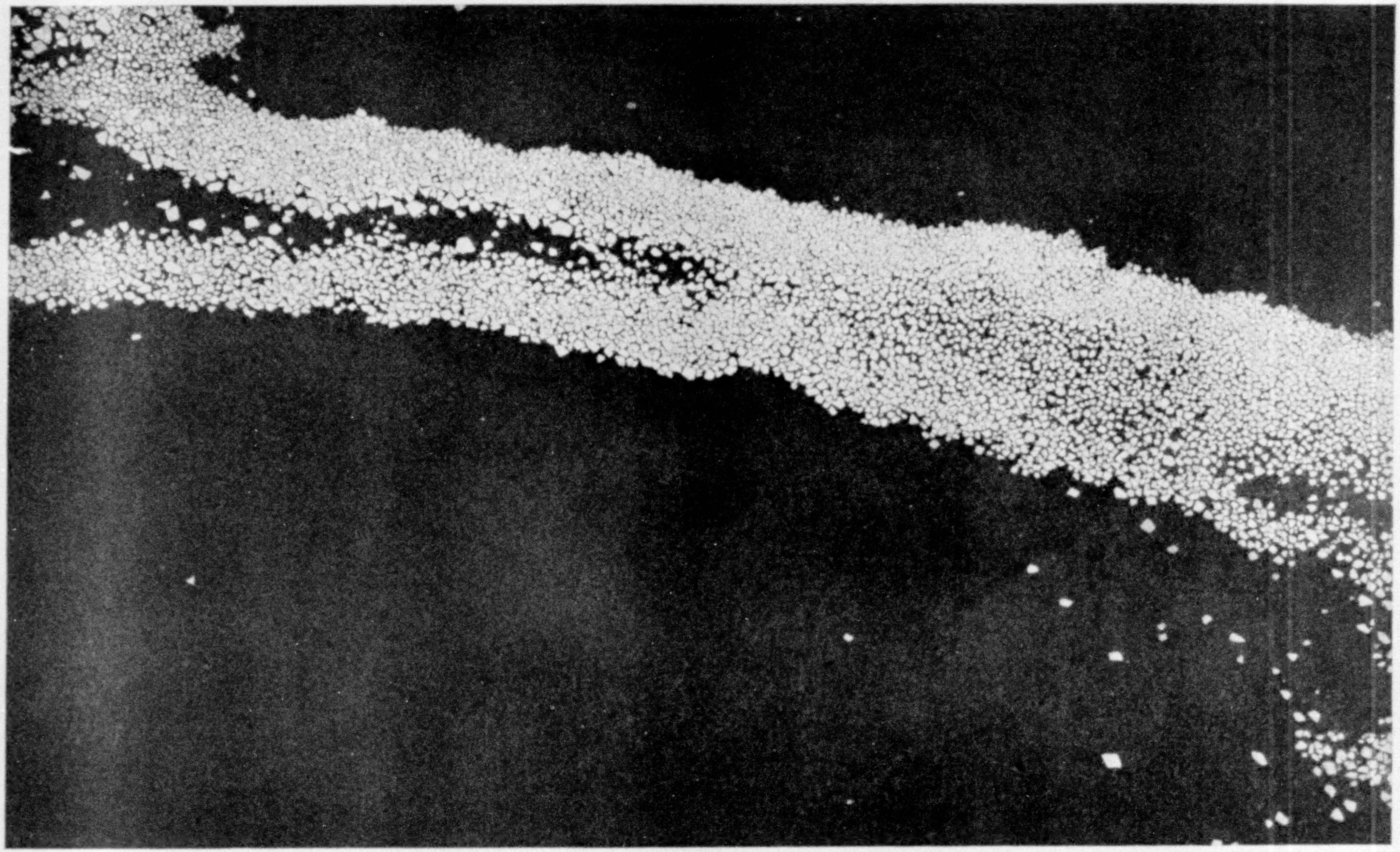
SCOUTING FOR A BASE ON THE BARRIER

We made up a little expedition of Balchen, Strom, Petersen, Vaughan, and Walden, using two dog teams. We headed for the eastern side of the bay and soon met impassable pressure ridges. There was a way up the barrier, however, and up we went. As this was our first experience in traveling on the barrier, I insisted upon those in the lead going roped. Visibility was then so bad, we might as well have been in a fog. The barrier sloped westward and we descended upon a little bay, where we made camp.

After several days of reconnoitering and short trips of exploration, we decided to establish Little America on the barrier just east of the bay, which we named "Ver-sur-Mer," after the seacoast town at which I landed when I flew to France. Here we erected two little tents and put up the radio.

When Vaughan and I returned New Year's night from a short trip, I discovered that Petersen and Balchen had prepared a New Year's dinner of pork and beans, bread and peanut butter, and apple sauce. No feast of turkey and cranberries tasted better.

The radio impressed me more and more. While we sat on the ice, Petersen tapped away on the key, communicating with our shipmates on the *New York*, and the *Bolling* in New Zealand, and our base radio



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RAW MATERIAL FOR THE GREAT ICE PACK DRIFTING OUT TO SEA IN THE SPRING

The photograph was taken from a high altitude and each of the pieces of ice, which resemble bits of confetti, is in reality from 10 to 20 feet across and nearly as thick.

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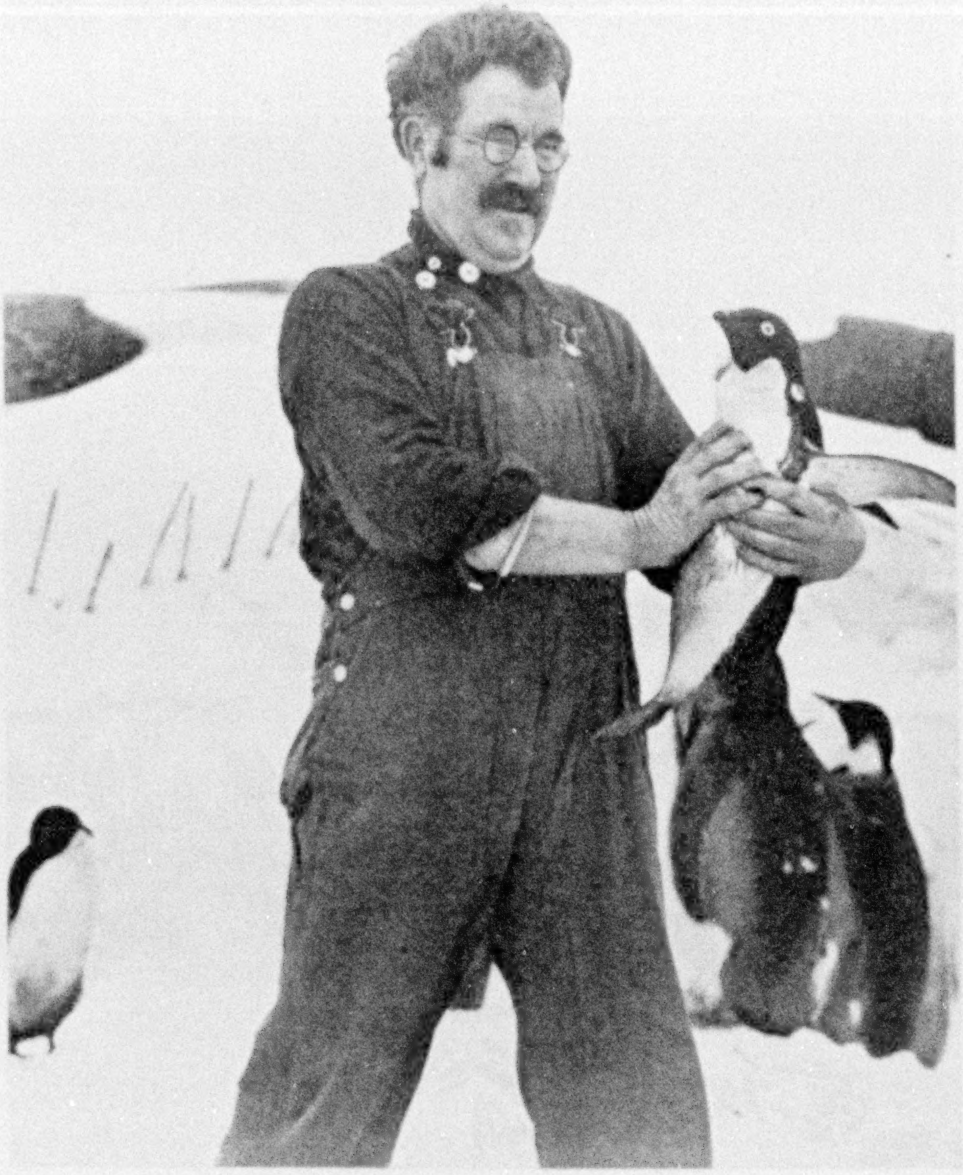
COUNTLESS HOURS OF CAREFUL CALCULATION AND PLANNING LAY BACK OF THE SUCCESSFUL POLAR FLIGHT

Perhaps the outstanding feature of Admiral Byrd's exploring expeditions and adventures is the painstaking and efficient preparation that has been made for them. Here he is discussing plans for the great flight with his fellow pilots. From left to right: Dean Smith, Capt. Alton Parker, Admiral Byrd, Bernt Balchen, and Harold June, gathered in the camp library at Little America.

ridge that appeared just ahead; it was, in fact, miles away.

And the dogs! Vaughan's leader, Terror, had pulled until he could scarcely stand, but he kept on struggling. We put him on the sled, let him curl up in the tent after a big feed, and next day he was as good as ever. For pugnacious courage and quick comeback, these Eskimo dogs are unique.

On our way back to the ship, January 2, we discovered a way around the pressure ridges on the bay ice to the west and decided to start hauling supplies to Little America. It was clear that if we did not proceed without delay we could not possibly complete the unloading of the ships.



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THERE WILL SOON BE ONE LESS PENGUIN IN CAMP

Perhaps the Adélie suspects that the cook's beaming countenance bodes ill for its future. At any rate, shortly after the picture was taken, the bird made a meal for some one. Most of the men liked breasts of penguin, while others objected to the fishy taste.

station relayed us news flashes from the United States. This was done with a temporary antenna rigged on a bamboo mast.

The odd visibility conditions in this eerie light fascinated us. Blurred shapes of icy hillocks, snowy peaks, vast, vague stretches of snow, the huge bulk of the barrier itself made up this deceiving world, in which nothing seemed quite so unreliable as the judgments of the eye. We would ski along and suddenly plunge into a depression just when the surface seemed perfectly level. We would see a pressure

GOULD IS NAMED SECOND IN COMMAND

I appointed Larry Gould second in command of the expedition and sent him in to Little America to take charge of the construction of the base, and a good job he made of it. I appointed Captain McKinley third in command. One of his responsibilities was that of keeping track of the thousands of different items that would soon be piled up in the snow awaiting the construction of buildings and storerooms. He did this difficult job effectively.

In order to prevent accident, we required that at least two teams make each journey together and keep in sight of each other. In addition, we kept a lookout posted in the crow's nest on the mast-

head of the ship. The departures and arrivals were reported by radio, and if any teams were overdue a party was sent out in search of them. Each man was required to carry his sleeping bag on his sled, in case his team should get lost in a storm. This was now of especial importance, as holes had begun to form in the ice on the trail. We put up orange flags to guide the teams in case of storm.

When the trail was good and the dogs were in condition, the teams made two round trips a day, covering thirty miles. The ice softened steadily. Men and sleds often broke through. The work the dog-team and dogs did is still a matter of amazement to me. They hauled over the bay and barrier more than 650 tons of material. They stuck to it without let-up.

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WHISKERS SOON BECOME ICICLES AT FIFTY BELOW

The temperatures at Little America were frequently so low that a man's breath froze and transformed his beard and mustache into an icy mass. The amber goggles were necessary to prevent snow blindness. This is Jim Feury, who drove the snowmobile (see page 190).

On January 14 we had word that the *Bolling* had again put out from Dunedin, loaded with several hundred tons of gear and supplies to augment the equipment aboard the *New York*. Each case was numbered, and every piece of cargo was checked as it passed into the hold and its location cross-indexed on a special file.

It was always our aim to have each unit of the expedition complete. We had with us on the *New York* a personnel of 54 men, one airplane, 80 dogs, 1,200 gallons of aviation gasoline, 75 tons of coal, and food enough to enable 54 men to spend 15 months in the Antarctic, including the four months of darkness.

The *Eleanor Bolling* was bringing, among many other items, two more airplanes, additional dogs, and 7,500 more gallons of gasoline. Our radio operators maintained a 24-hour contact between the *New York* and our Dunedin base, enabling me to direct and consult about additional supplies, even when we were camping out during the reconnaissance for the expedition's base location.

Meanwhile the men continued the herculean task of moving from ship to Little America, setting up there a completely appointed and self-sufficing American village on the frozen continent, electrically lighted, heated by kerosene stoves, water-supplied, and artificially ventilated.

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"CIGGY ANTE" REPLACED "PENNY ANTE" AMONG THE EXPLORERS

Money was a useless encumbrance in Antarctica, so cigarettes were used as stakes in this poker game (note the banker's cans piled on the corner of the table). Admiral Byrd finished 30,000 points ahead in a single night of bridge, but the night was four months long.

"Anyway," some one suggested, "you will not need a refrigerating system."

That would have been easy. The extreme cold, yielding temperatures down to 72 degrees below zero, and strong winds brought problems of their own.

We had our gasoline put in copper cans. Some food was packed in glass. We carried more than 1,200 items of food, all selected after scientific study of their body-building, heat-producing, and preservative qualities.

NO NAILS USED IN ANTARCTIC BUILDINGS

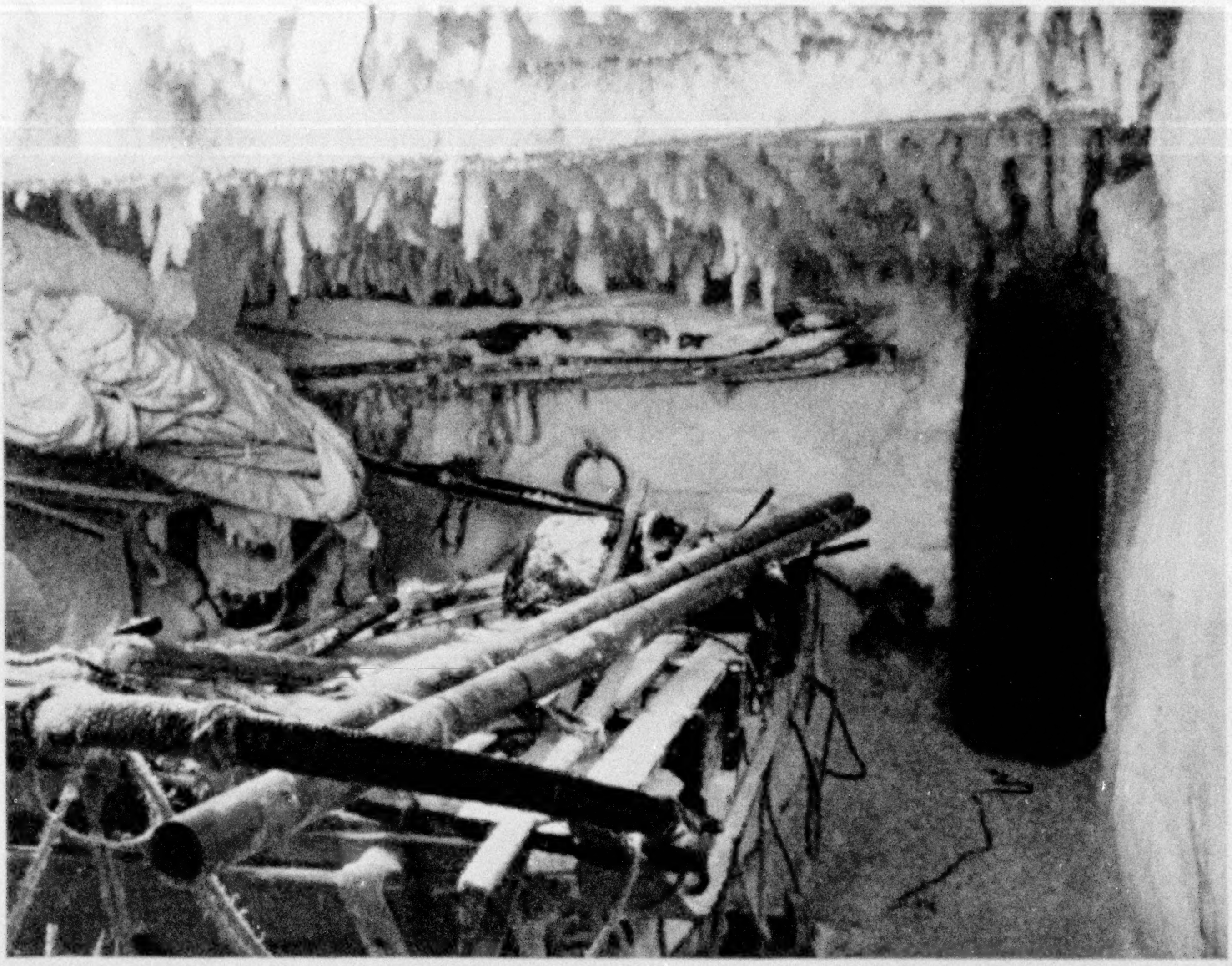
In the United States, the consulting engineer of the expedition, Edgar Barratt, had worked out a standard method of putting up light, strong, weather-tight, wind-resisting buildings, which were to serve as the executive building, bunk houses, mess hall, and machine shop. The walls and roofs were 4 inches thick and painted orange color, so they could be seen from planes.

The outside layer was a stiff building board, 1½ inches thick. Then came 1½ inches of kapok insulation, a layer of fiber insulating board, more fiber building board, and, on the inside, three coats of oil paint.

This material was already compressed and fastened to frames of yellow pine in sections 3 feet by 8 feet, each section weighing 106 pounds, so they could easily be handled by two men.

Not a nail was used. The beams supporting the buildings were held by bolts which did not go to the outside, so they would not transmit cold.

The big executive building had rooms fitted with desks, drawing boards, and other apparatus for the physicist, geologist, and meteorologist. There, also, was our very complete library, presented by Mr. David Layman.



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JACK FROST TRIES HIS HAND AS AN INTERIOR DECORATOR

The roof of the sledge repair shop was hung thickly with beautiful frost crystals, and whenever a member of the expedition struck his head against one of these he received a frost spray down his collar.

The physician had quarters which also served as a first aid and hospital room. In this building, too, was the radio laboratory.

Then we had to put up a mess building, which was used also as a bunk house, and adjoining that another bunk house, with communication tunnels from each to the mess building. The photographic laboratory adjoined the mess hall. The machine shop was near by. A weather station was set up. Far to one side was a magnetic observatory, and on the other side of our village were the 70-foot radio towers, staunchly built, and stayed with wires.

REDUCING THE FIRE HAZARD

On account of the fire hazard, primarily, we isolated the buildings, the mess hall being separated from the executive quarters by more than a hundred yards. If one of the big buildings should burn up, we would have one intact and, besides, the arrangement would enable the men to pay visits and thus eliminate some of the monotony.

Walden and Braathen built a comfortable little house from airplane crates and boxes, a hundred feet south of the mess hall, and Braathen made a blubber stove from a gasoline drum. They were really quite well off.

Most of the dog-team men lived in the Norwegian house, which lay between the executive quarters and the mess hall. Czegka's machine shop, the aviation workshop, and Hanson's radio storeroom were also built from boxes and airplane crates. Most of the other rooms were carved out of snow, as, for example, the doctor's storeroom, the gymnasium, the meteorological station, and the magnetic house. Tarpaulins were put over these. The roofs, of course, were soon covered with snow.

Nature made a tough task harder. A 10-foot crack opened in the bay ice be-

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A YOUNG CRAB-EATER SEAL VISITS THE EXPLORERS

The species is not so common as the Weddell. This youngster was kept in captivity for some time and studied carefully. He often entertained his captors by rolling over on his side and emulating a canary with his shrill whistling tones. He is not a fur seal, but, like all his tribe, is a graceful and efficient swimmer.

tween the ship and the main base, adding two miles to the sled run. That increased the round trip for the teams to 18 miles.

We were interrupted by a snowstorm that lasted two days. It caught us with the first house only half built, and the men at the base, safe and snug in their tents, were fearful that their uncompleted house might be blown down and scattered over the snowscape.

Meanwhile the ship faced even graver danger. We had to keep a constant watch upon our ice anchor lines. For hours at a time it seemed as if the terrific strain must snap them. If the wind had veered we would have had to cast off, lest the wind jam the ship against the ice.

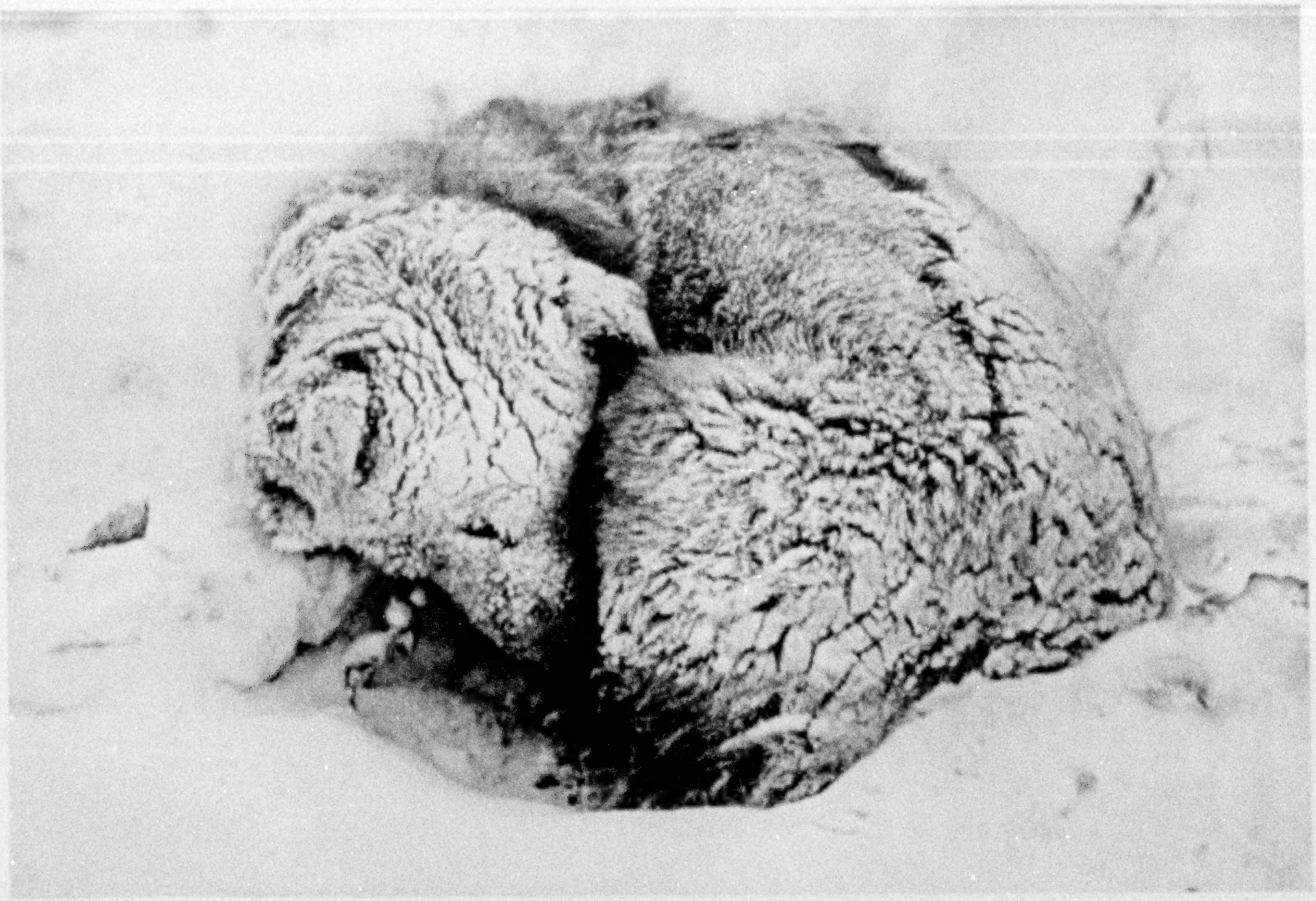
When the gale subsided, the ship was still at anchor and our unfinished house was intact, although it was a disheartening job to have to dig out the foundation again.

On January 14 we put ashore the airplane we had brought down on the *City of New York*. It was the Fairchild, a high-wing monoplane. It had a 425-horsepower radial air-cooled Wasp engine that could make 140 miles an hour top speed, and a service ceiling, with full load, of 15,000 feet. It was built primarily for high-altitude photography and had a glass floor and slide under the pilot's cockpit, wide windows, and a glass windshield.

Under the direction of Harold June and Strom, the heavy crate in which the fuselage rested was swung thwartship, resting on a bulwark and a pile of timbers. Then the bolts were unscrewed and the sides removed, revealing its clean, symmetrical lines.

It was slung over the side with infinite care, men holding grimly to the guy ropes and protecting it with their bodies from scraping or scratching. The wings were carried over the side on the shoulders of the men, down a slippery plank, with not a single mishap.

I was pleased with the swift, workmanlike job of those men—with the way they got that plane overboard and assembled



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BLIZZARDS DID NOT WORRY THE ESKIMO DOGS

Covered with snow and ice, they slept out in the open at subzero temperatures, sometimes throughout a blizzard, with only their noses showing. A heavy outer coat of hair and a furry inner lining almost as thick as felt makes this possible.

it on ice which threatened to shift out to sea any minute.

"STARS AND STRIPES" MAKES FIRST FLIGHT

This plane we called the *Stars and Stripes*. On January 15 we made our first flights, seven times up, exploring unknown country to the west and a deep inlet in the barrier.

The motor was heated by a torch placed under a fireproof covering, warm oil was put into the tank, and Bernt Balchen climbed into the pilot's seat. Dean Smith and then Kennard Bubier turned over the inertia starter.

Balchen snapped on the ignition, the motor sparked and settled down to a smooth, even roar. Balchen nursed the engine, then opened wide, and the plane trembled and shook under the thrust of the propeller. The wind cut deep, and vivid light hurt unprotected eyes, but no one thought of the cold. Icicles had gathered on the slot of the ailerons—a suggestion of a major menace of this frigid air flying.

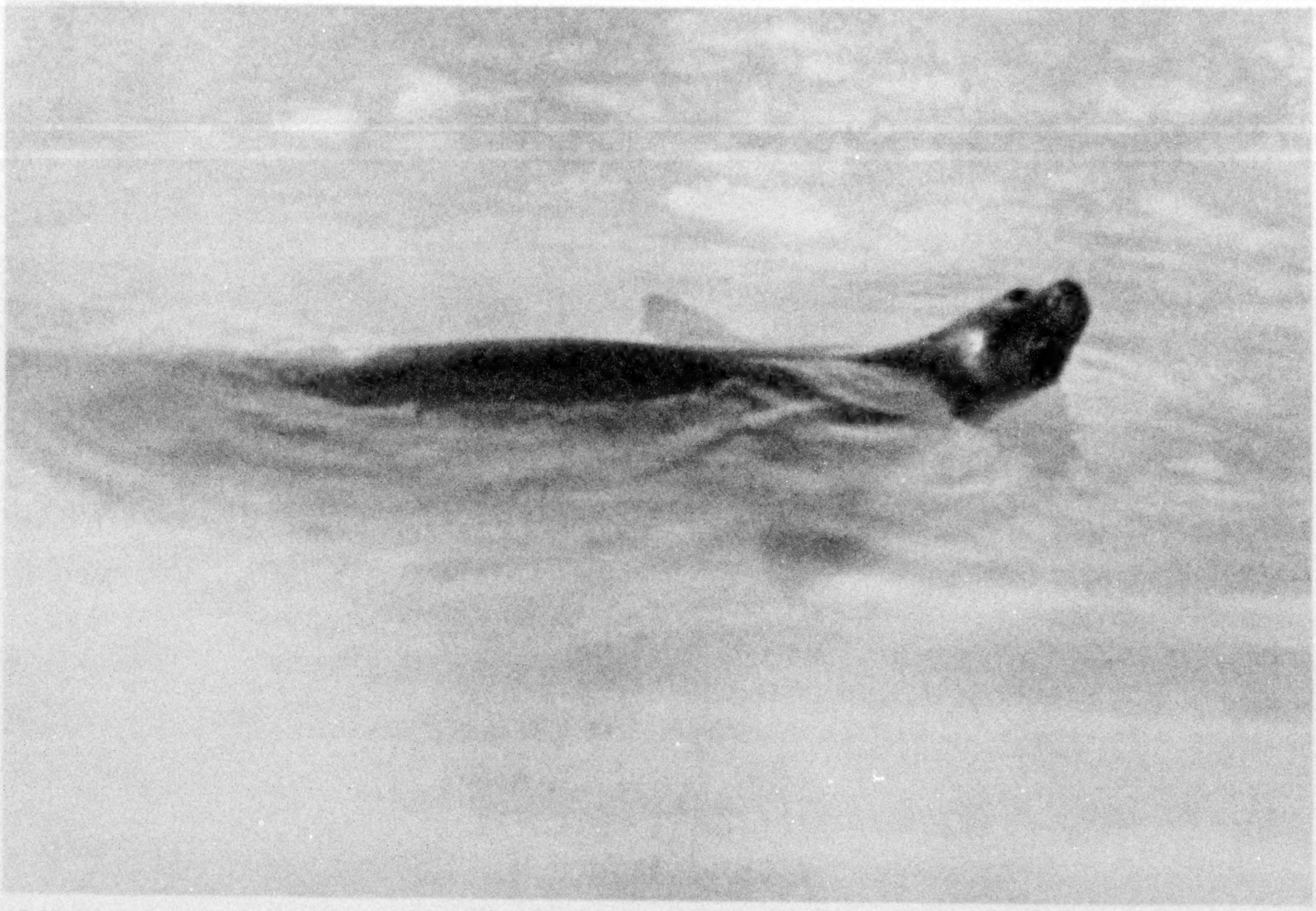
Balchen turned the controls over to Parker. The mechanics cut for the first flight. Bubier and Demas won. It was the least I could do to honor these men, who worked hardest to make our flights successful and usually get scant glory.

Smith, June, and I took the air at 3:45 o'clock. We set a course to the southwest, and in ten minutes we were peering upon areas never before seen by man.

BUMSTEAD SUN-COMPASS AGAIN USED

In short order we discovered all three of our magnetic compasses were useless, owing to our nearness to the South Magnetic Pole. So we used the sun-compass, first devised for me in 1925 by Albert H. Bumstead, chief cartographer of the National Geographic Society. It was the same compass we used on the North Pole flight, except that the pointer was made to revolve in the opposite direction.

We were flying over an uncharted harbor, about three miles deep, on the west side of the Bay of Whales, and as I



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SLOW AND AWKWARD ASHORE, SEALS ARE GRACE ITSELF IN THE WATER

Nature has provided well for these Antarctic creatures, for they have no enemies ashore and therefore no especial need of speed or fighting equipment. However, when in the sea the price of survival is their ability, through wonderful speed and agility, to elude the savage killer whales and sea leopards.

watched our magnetic compasses swinging giddily I thought of the troubles Clarence Chamberlin had with his compasses at the beginning of his transatlantic flight. I named the harbor for him.

Ahead of us stretched a vast snow-covered ice field that the eye of man was scanning for the first time. We felt the lure of entering the unknown. We got a kick, as we did many times thereafter, by looking through our glasses to spot something new to put on our maps. One of the advantages of the position of Little America was that it was surrounded by unknown areas.

LINDBERGH INLET IS WRITTEN ON MAP

After about 25 miles we sighted a beautiful inlet, with ice cliffs rising vertically for a hundred feet on each side of its mouth, which was about 1,500 feet wide. I believe the mouth of this inlet had been sighted before. Back of the inlet, which was 20 miles deep, was bay ice, smooth as a billiard table, and there hundreds of seals lay alongside a pressure ridge. They craned their necks at this strange bird making such a terrific noise.

To the west we saw a cloud formation similar to one I had observed while crossing the Atlantic. We thought of the man who had led the way, so we named the inlet for Lindbergh (see sketch map, page 132).

We had sleeping bags, a sled, and other equipment in the plane, to be used in case of a forced landing. But this was our first day's flying, and we decided to be conservative and turn back after going a short distance south of the bay.

Halfway back to the ship the motor stopped dead. Smith nosed the plane toward the snow, realizing, with his usual quick thinking, that one of the gas tanks had gone dry, and turned the proper valve. Our downward speed started the engine again.

Visibility was bad when we arrived at the base, but Smith made a perfect landing. We had been up an hour and a half

Photograph courtesy Paramount Publix Corp.

A SNOW PETREL TAKES CAPTIVITY PHILOSOPHICALLY

Only a few varieties of sea birds brave the frigid blasts of the far southern continent, even in summer. In addition to this and other kinds of petrels, the Byrd party saw large numbers of penguins and skua gulls.

and had explored approximately 1,200 square miles, which would have taken weeks to traverse on the ground.

One sunny night, January 25, Malcolm Hanson, chief radio operator, sent through the first radio message from our plane to New York—the distance record, to that date, for two-way communication with an airplane in flight. WFC (call letters of the *Stars and Stripes*) signaled WHD, the *New York Times* station, at 8:15 p. m. Antarctic time, 3:15 a. m. New York time. For 12 minutes the dots and dashes cut through the climate zones, crossed the Equator, and New York flashed back that it had the message verbatim.

I am trying to tell one thing at a time; but things were happening so fast these two weeks they must seem jumbled. They did to us.

Two houses had been erected. We continued to move supplies. Day by day men and dogs struggled over the trail, hauling tons and tons of supplies to our base.

Each day had its new adventures. Once while a party was with me in a motor boat trying to find a berth along the bay ice nearer our base we were chased by killer whales. To me killer whales are terrifying creatures. They are bigger than the average shark, are carnivorous and pugnacious. They travel in schools and make quick work of the great 80- or 90-ton blue whales on which they prey.

On this occasion a school of killer whales passed near us and came to the surface to blow. As they did, they saw us and started full speed ahead in our direction. We turned and scrambled on the ice, as the whales caught up with us. They all dived under the ice, and we then watched to see whether they would come up under the ice and smash it with their noses, as they do when chasing seals. However, they went away. The morning of the day the barrier broke we saw at one time as many as eighty of these whales in the bay.

On January 22 the edge of the bay ice to which our ship was moored began to

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THE RETURN OF THE SUN WAS OCCASION FOR A CELEBRATION

The long night was extremely monotonous and there was great rejoicing at Little America upon returning daylight (see text, page 182).

break up. Four dog teams were rescued from floating ice, and our 100-pound ice anchors were taken in while we shifted the ship to a new position.

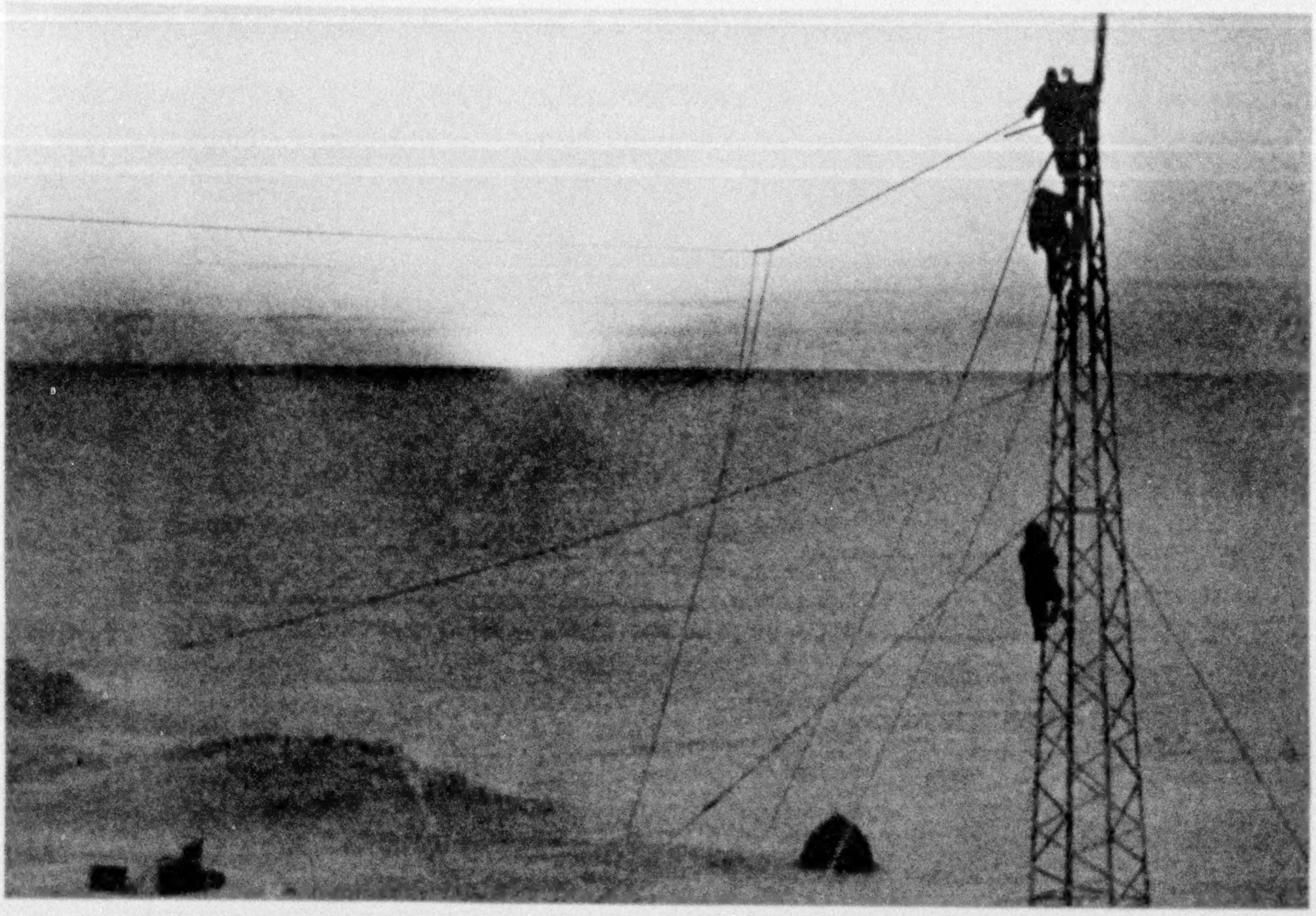
ANTARCTIC FLIGHT EMERGENCY EQUIPMENT

On the day the *Eleanor Bolling* was due to arrive (January 28) weather conditions were so ideal for flying that we took off on an exploration trip to the region of the Alexandra Mountains, to the east. If we should have a forced landing we must upset the biggest operation of the expedition, which was the unloading of the supplies. But flying opportunities were too few to miss. The vast unknown area over to the eastward had long held my imagination. I was impatient to start.

I wish to make clear a point about exploration in the Polar regions by airplane. The cruising radius of a plane is much reduced on account of the extra weight which must be carried in the event of a forced landing a considerable distance from the base. This includes food, sledge, and camping equipment, emergency ground radio, pressure gasoline stove for heating the engines, extra clothing, etc. A forced landing in the South Polar regions, far away from base, is more serious than in the Arctic, as the continent is lifeless. Even with the most careful preparation, men cannot walk far with what they are able to pull on a sledge. By putting down bases they can, of course, travel great distances, but on this trip we would have no bases on which to depend.

We had 700 pounds of equipment in the plane. The cabin was so full of gear we were cramped. The take-off was rough, but we got off with our heavy load in 30 seconds. Balchen's face and June's reflected my own relief. This demonstrated we could take off from the snow with a heavy load without breaking the skis.

While in the air we received a radio message that the *Eleanor Bolling* had reached the barrier. As far as I know, this was the first steel ship ever brought by an Antarctic expedition as far as the barrier. I had been severely criticized for using a steel ship, but had decided the *Bolling* could make the trip if we waited



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CLIMBING THE RADIO TOWERS TO GET A PREVIEW OF THE RETURNING SUN

Having said good-bye on April 18, the sun did not reappear on the horizon until August 20.

patiently for the ice to break up. There was no wooden ship large enough to carry the planes and other supplies. Captain Brown and his officers and crew had done a fine job.

THE FIRST IMPORTANT DISCOVERY

To get back to the flight. After an hour or so we passed a beautiful bay in the barrier, a bay about 10 miles deep, with a mouth several miles wide. I named it Hal Flood Bay for my mother's brother. A few minutes later I saw to the right a peak sticking up out of the snow and marked it for future investigation.

We raced on and a peak loomed dead ahead. It was Scott's Nunatak, a bit of bare rock. The valiant Scott saw this peak in 1902 from his ship. But we got a little nearer; the ice turned him back. In 1911 Lieutenant Prestrud, of Amundsen's expedition, reached it after weeks of struggle along the coast line.

A nunatak is a bit of rock protruding from the snow. To the east stretched several such peaks. Scott named them the Alexandra Mountains. They are approximately 1,500 feet high and several of them disclosed bare rock on their northern sides.

We flew on, at an altitude of about 3,000 feet, and then we began to dodge snow squalls. I was greatly disappointed that we could not continue in this direction, for we had penetrated beyond known areas. Visibility to the south seemed best, so we set our course inland and headed south for the peak I had seen earlier. The air became bumpy; once we dropped 500 feet.

We were flying at about 4,000 feet. Suddenly Balchen yelled and pointed. There appeared a mountain peak showing large expanses of bare rock. It was the peak we had seen to the right earlier in the flight. One peak after another loomed up behind it, as we drew nearer.

We had made our first important discovery: I counted fourteen mountain peaks (and there were more) running north and south for about 30 miles. Here was something to put on maps; here was a fine laboratory for geological exploration. Then the inevitable question, What is beyond this range? But our gas was low and we had to turn back, arriving

safely after a five-hour flight, having seen some 10,000 square miles of territory.

These mountains I named for John D. Rockefeller, Jr.

We had little respite for elation. Every man turned to the task of unloading the *Eleanor Bolling*. We were working against time. While we were on the flight both ships had hammered their way to an incline leading to the barrier. The snow formed a fairly adequate dock. We swung the cargo overside onto the snow and worked like beavers hauling it to the top of the barrier.

The next day, January 29, during a heavy swell, our dock suddenly broke up into many great hunks of ice, which were tilted at crazy angles, as in a cubist picture. Among other valuable things, the center section of our Ford plane lay upon a rectangular block of ice which was slowly tilting at an alarming angle, while the gap between it and the ice cake nearest the ship steadily widened. All the men were ordered to don life preservers. They worked with reckless courage and saved everything except two bags of coal. The next day we saw the coal floating far out to sea on a miniature iceberg.

LONG CHANCES THE PRICE OF SUCCESS

Where should we go next was the question. The barrier at the point where we were unloading was then straight up and down and about as high as the *Bolling's* bridge. To go alongside and unload afforded the only possible way of accomplishing our mission.

I knew the danger caused by huge portions of the barrier breaking off without warning. However, we had to take that chance. We had taken exactly the same kind of chance at Spitsbergen, when we ferried the plane ashore through a shifting ice field. In Polar regions there inevitably arise occasions when to succeed one must take long chances. As far as my men were concerned, the greatest difficulty I always had was to keep them from taking reckless risks. We tied up to the barrier with the *Bolling* alongside and the *New York* outboard, secured to her by lines.

We worked day and night. We used tackles, winch, and long lines to hoist the material to the barrier. An incredibly large amount was transferred in a short time. I could get no sleep, knowing the risk involved, not only to the success of the expedition, but to the lives of the men. I believe it is impossible for any one to realize how tough it is on a leader to have his men in grave danger.

THE BARRIER BREAKS—A RESCUE

January 31 I was sitting in my cabin talking to McGuinness, the mate of the *Bolling*. With the bulk of material ashore, we expected soon to cast loose from the barrier. Suddenly I heard a frightful crash. I was at my door in an instant. I knew what had happened before reaching it—the barrier had broken. I saw the bottom of the reeling *Bolling*. Why she did not capsize I do not know, with this iceberg rocking on her deck.

Men were yelling. There was certain to be a number of them in the water. I ordered the boats over. I could see Captain Brown giving the same order on the *Bolling*. Benny Roth was in the water, clinging to an ice cake, which was going around and around. He shouted he could not swim, and was having a difficult time holding on, being weighted down by heavy clothes and boots. I went overboard after him, but was blocked off from him by snow and ice shooting swiftly between us. Harrison was hanging over the barrier on a line.

When the lifeboat from the *New York* hit the water, too many men piled into it. Hanson, one of them, saw this and jumped into the water. Men on the barrier pulled Harrison up over the edge. There were anxious moments until Roth was rescued. Investigation showed that no more men were in the water; all were safe.

In spite of these mishaps we had the *Bolling* unloaded in 5½ days, and on February 2 she started back to New Zealand. Among the food supplies she had brought us were 20 cases of grapefruit and oranges. It was odd to see a man perched on an icy hummock eating an orange.

The first two weeks of February brought a series of storms, and we had to put out in the bay a number of times to save the *New York* from being dashed against a barrier or crushed by an iceberg.

The drift of the ice in the Ross Sea was to the westward. It would generally

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AERIAL CONQUEROR OF THE ENDS OF EARTH

Admiral Richard E. Byrd, accompanied by the late Floyd Bennett, flew to the North Pole from Spitsbergen in 1926. On November 29, 1929, with three companions he succeeded in flying over the earth's most southerly point. The explorer is dressed in the caribou skin suit which he wore on his South Polar flight. Igloo, a pet terrier, accompanied him on both expeditions and has thus spent much of his life in the regions of ice and snow.

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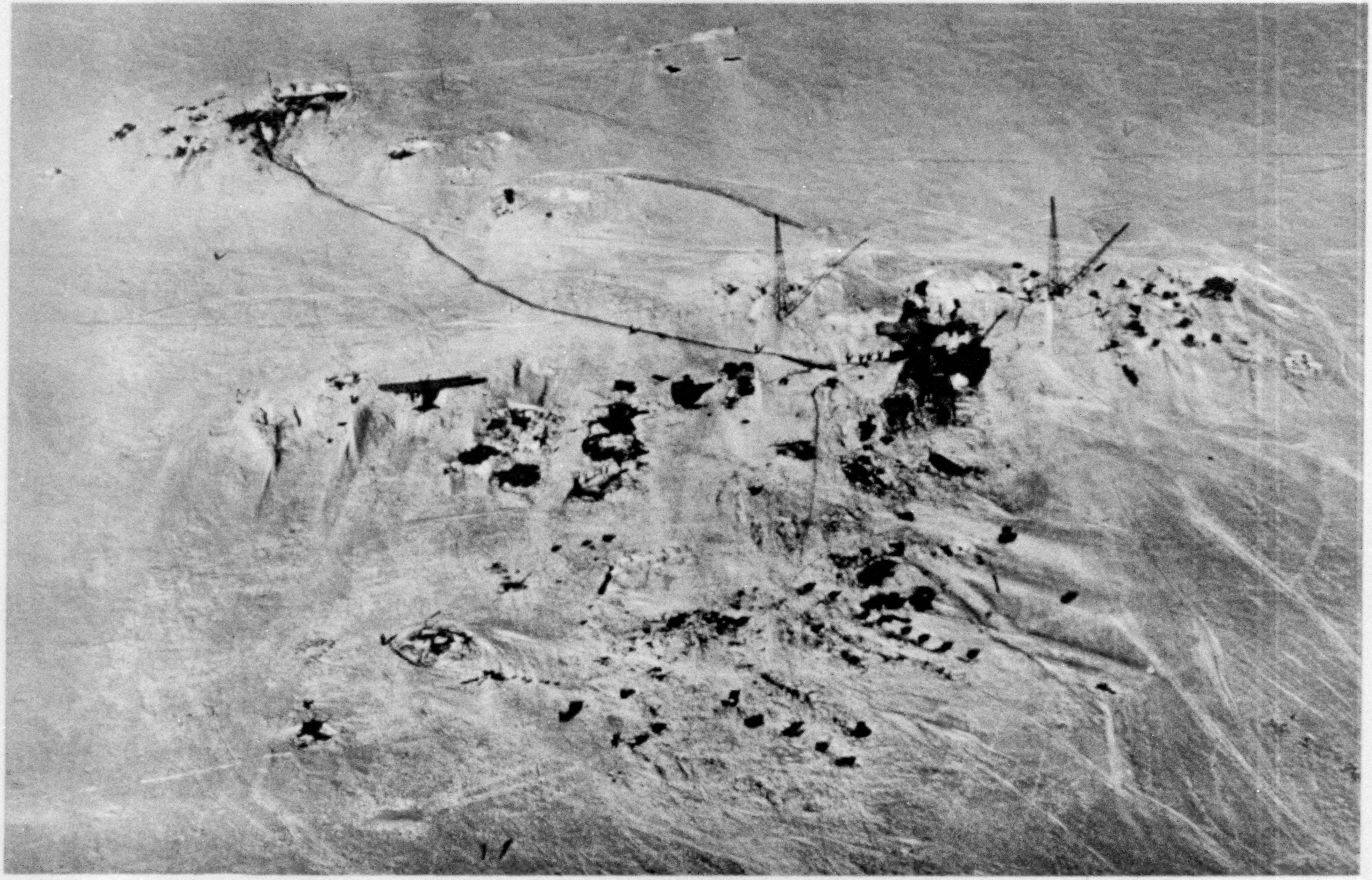
THE "CITY OF NEW YORK" FOUND HARBOR IN THE BAY OF WHALES

The bay ice rises about five feet above the surface of the water, thus creating an excellent dock. When the ship was at this point, in January 1929, it was necessary to haul all supplies eight miles by dog team to the point on the barrier where Little America was located. Later in the year more of the ice broke out and she was able to dock at the barrier edge only five miles from the expedition's base.



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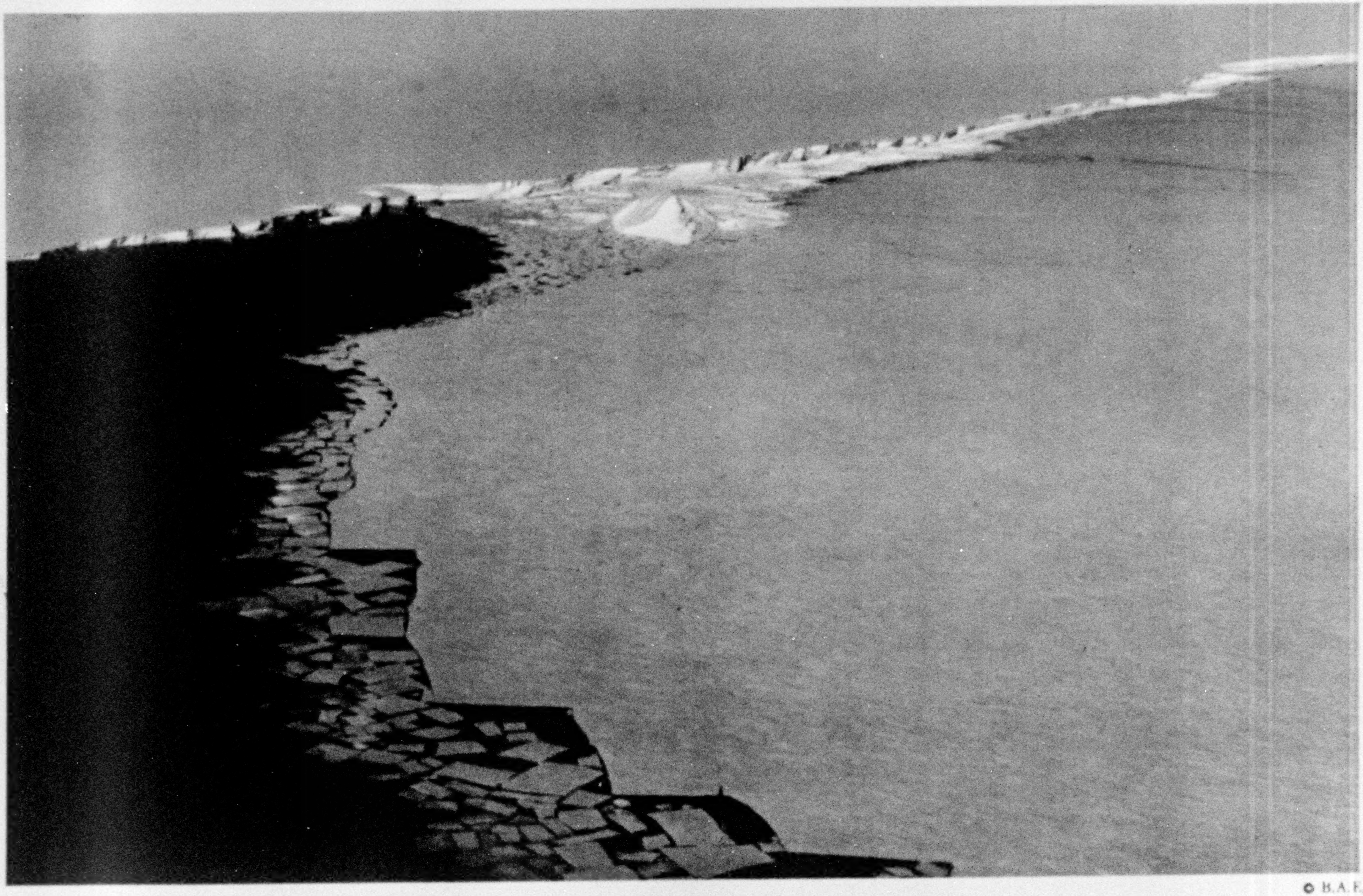
LITTLE AMERICA, ADMIRAL BYRD'S ANTARCTIC CAPITAL

The structure seen in the left background is the Administration House. On the right, between the radio towers, is the Mess Hall, the two houses being connected by a tunnel dug six feet deep in the snow. Little America was located on the Antarctic Barrier with about 100 feet of packed snow and ice and 1,400 feet of cold water beneath it. Note the second plane, *Stars and Stripes*, nesting on the snow, left of center.



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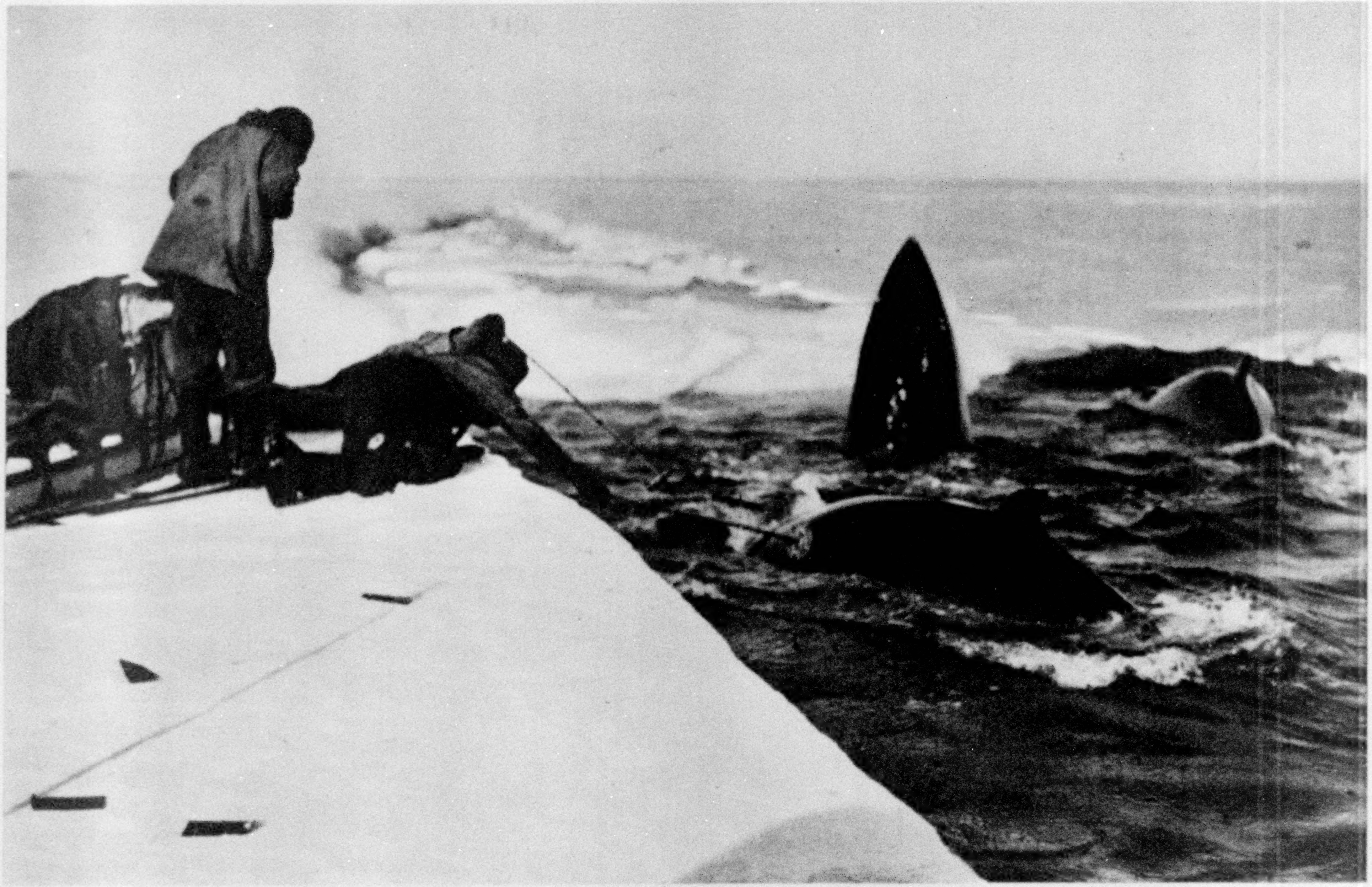
SPRING IN THE ANTARCTIC IS NOT A SEASON OF WILD FLOWERS AND BIRD SONGS

The life-giving season is simply a time of more sunshine and less ice and snow in the South Polar region. Ice in the Bay of Whales is here shown breaking up under the sun's rays in the spring of 1929. While from the air it looks not unlike a litter of paper, this ice was about fourteen feet thick. During the fourteen months which the Byrd Expedition spent at the Antarctic base, only two days recorded an air temperature over 32° Fahrenheit.



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SHIFTING ICE PROVIDED THE "LITTLE AMERICANS" WITH STRANGE PLAYFELLOWS

These whales followed a lead in the bay ice in search of food and were trapped in a 40-foot crack when a change in wind or pressure shifted the ice and closed the lead. They showed absolutely no fear of the men "tickling" them with ski sticks and spent much of their time standing straight upon their tails with heads out of the water, probably looking for another open lead. These are little fellows—only about 25 or 30 feet long.

© B.A.E.

FROM A HEIGHT OF 4,000 FEET, 20-FOOT CREVASSES LOOK LIKE SKI TRACKS

A surface such as this, about 150 miles from Little America, offers grave hazards to the traveler afoot, for the crevasses fall sheer away for a hundred feet or more to the icy waters beneath the barrier and often the snow which covers them will not sustain a man's weight. Some scientists take the occurrence of these much disturbed surface areas to indicate the probable presence of land beneath them.

© B.A.E.

THE DOGS LOVED TO WORK AND WOULD PULL UNTIL THEY DROPPED IN THE HARNESS

The 80 Eskimo dogs which accompanied the expedition proved themselves invaluable for hauling supplies between ship and base. They have a strong wolf strain and while very gentle with humans, are vicious fighters among themselves and they fight to kill. Frequently two of the huskies form a close friendship and stand together against all comers. The dogs were fed principally on seal meat, which was easily obtained and very nourishing.

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SIX HUNDRED AND FIFTY TONS OF SUPPLIES AND BUILDING MATERIALS WERE HAULED ACROSS THE ICE

Over this trail the dog teams worked back and forth for weeks during the construction of the expedition's base. On the second sled is a section of one of the ready-to-erect houses set up in Little America. The long shadows of the dog-drawn sledges indicate that the sunless winter night is not far away.

pass the mouth of the bay like the marching of an infinite white army, but frequently it invaded the bay and threatened our ship. We had to keep on the move. There was even graver danger of being caught in the clutches of the pack ice and becoming a prey to the icebergs which prowl through this floe ice. The momentum of a berg could easily crush any ship. Storms came frequently during the last week and finally we had to put to Ross Sea to save the *New York*, with her low power, from being dashed against the barrier. Under the conditions, this would have been equivalent to striking a rock cliff. These were anxious weeks, but they gave us an unparalleled opportunity to watch the drift of ice from the great unknown region in the east.

This vast frozen flood seemed to me to indicate that this unknown area must be at least in part an archipelago. So anxious were we to get into that area that we made several attempts to follow the barrier in the *City of New York*—one of them an almost desperate effort. But we were forced back each time by the elements, the last time by a blinding storm and thick slush ice which was forming into solid floe ice.

But we continued to try. The next time we tried from the air. On February 18 weather was propitious, and we took off with two planes. Balchen and I flew in the *Stars and Stripes* and Parker and June in the Fokker, which I had named the *Virginia*.

The thermometer registered 18 to 20 degrees below zero on the flight, but we were dressed warmly and it was comfortable in the cabins and cockpits.

NEW LAND SIGHTED

Past the Rockefeller Mountains I wrote Balchen, "I think I see land to the east. Let's try." We flew toward the mountain for some time without its appearing to be appreciably nearer. We then turned south again.

We continuously checked our magnetic compasses with our sun-compass. We were changing direction so often that navigation became a real problem.

The mountain was a Matterhorn-shaped peak. We decided to wait for clearer weather to the east to investigate it.

We penetrated about 100 miles beyond the farthest south attained on previous flights. There were appearances of high land farther to the south; but deception and mirages have misled so many seasoned explorers that I hesitate to make definite assertions which I cannot back up with photographs. However, we were rewarded positively in this flight, for we discovered a magnificent new mountain peak east of the Rockefeller Mountains. Land was almost certain to be over there, east of the British claims.

When we returned to Little America, McKinley asked permission to make a mapping flight along the coast in the Fairchild plane, which I granted. After he started I walked back to the *City of New York*. As I entered the radio room the loud speaker made audible the note of the plane's generator, pulsating with a beat corresponding to the speed of the engine. Every now and then a message came in reporting his progress. In one message McKinley reported he could see the Rockefeller Mountains and asked permission to photograph them with the mapping camera. To this I agreed at once in a return message. He was then more than 100 miles away.

It was as fascinating as it was reassuring, to be able to sit there and communicate by radio with every unit of our expedition; with our supply ship, bound south again from New Zealand, with our base on the ice, with an airplane in flight.

Our ship was picking its way out of the bay—we were making another attempt to reach the area north of King Edward VII Land by sea—when we saw the *Stars and Stripes* flying a mile high, heading back from base. We peered at her through the "frost smoke," caused by the cold barrier wind striking the warmer water.

McKinley reported he had made a strip map of Rockefeller Range, and had seen the new mountains about 80 miles to the east. There was one impressive peak, the height of which he estimated to be about 5,000 feet. This was the same peak we had seen, but he had a better view of it, as the clouds had cleared from its base.

Weather thwarted the attempt to take the ship northeastward. The smoking fog on the surface obscured the ice and small bergs beyond a short radius. Moisture

Photograph courtesy Paramount Publix Corp.

MAKING FRIENDS WITH A NINE-FOOT ANTARCTICAN

Weddell seals played an important part in the expedition's commissary calculations, for they furnished much of the food for the 80-odd sledge dogs. These seals are sluggish when out of the water and fall an easy prey to the meat hunter. They sometimes attain a weight of a ton or more (see, also, illustration, page 171).

coated the ship with frost until every spar and rail was glittering white.

The new land we found on our flight I named for the person who, in the words of Admiral Peary, "bears the brunt of all my undertakings"—I called it Marie Byrd Land—and I claimed this territory, which lies outside the claims of Great Britain, for the United States (see map, page 132).

DIGGING IN FOR THE ANTARCTIC NIGHT

Our first exploring season, all too brief, was now over. We made ready to dig in for the long Antarctic night.

On February 22 we stood at the edge of the ice and watched the *New York* disappear in the mists that shrouded the Bay of Whales. If the *Bolling* should not be able to get through to us again, as I suspected would be the case, we were now isolated on the barrier for a year. Until summer came again, no vessel could penetrate the winter ice of the Ross Sea. We turned inland over the trail, the dogs' tails flying like plumes, as they sped over the hard surface. Parka hoods were covered with snow. The men joked as they tipped one another over into the drifts. We were alone in the Antarctic!

I was greatly moved by the loyalty of those who had to go back to New Zealand. Theirs was the hardest job and their hearts were well-nigh broken. But some one had to go back, and they were, equally with us, links in the chain.

Messages I received from the *New York* were ominous. I quote from my diary a message received on February 23:

"Ice seems thicker continually and is in pans of several acres each. A few minutes ago struck a big area and broke ice about four or five inches thick for more than a mile. Making only about one knot. Freezing seems to be going on continuously and in a few hours the *City of New York* would have made headway only with great difficulty. The ice is also freezing in our wake as we pass."

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FROZEN SPRAY MADE A PHANTOM SHIP OF THE "CITY OF NEW YORK"

The likeness to a ghost was in appearance only, for so heavy was the accumulated ice that it threatened at one time to sink the ship on its perilous voyage through the pack ice (see text, page 226). All hands worked desperately to cut away the ice faster than a new coating could freeze.

I was also informed that the ice was freezing around the rudder, so that at times it could not be moved. Constant work was necessary to keep it free.

A short time later I received the following message from Captain Melville:

"We have the wind S.S.W., force 4, under steam and sail pushing our way through new ice as far as the eye can reach. The thickness of this ice is from 6 to 12 inches and appears to be forming between the widely separated ice packs, which are small but can be seen in every direction."

Later on the *New York* got stuck and had to retreat before she found a place where she could batter through.

Several hundred miles farther north the *New York* came up hard against an impenetrable ice pack. As she was running short of coal, the situation again appeared potentially dangerous. The whalers were north of the pack, and I appealed to Captain Nilsen, of the *Larsen,* to direct one of his fast chasers to find a way around the pack for us, which would be difficult for the *New York* to do on account of her very slow speed. This he did, and a route was found to the westward. Nilsen then recoaled the *New York.* The day was saved and the ship presently reached New Zealand in good shape.

Meanwhile the *Bolling* had been on her way south with additional supplies. On February 26, after advices from the whalers and in view of the tough time the *New York* had had, I ordered her back to New Zealand. The crew of the *Bolling* had always displayed great spirit, and I know it was tough for them to be compelled to go back.

I got the following message from Captain Brown:

"Your very sad message received. Sorry not to go through. All hands are 'raring' to go. We have not seen any ice so far and why don't you let me try? You know experts said before it was impossible to go to the Bay of Whales. Would a depot at Scott's last winter quarters in McMurdo Sound do any good? You know me and

my gang will go to hell for you. Please answer, as we are still hoping."

The spirit of the captain and crew of the *Bolling* was always splendid, but it was well she turned back. Even if she could have bucked the pack and the new ice in the Ross Sea, she would have been stopped by the ice that filled the bay. From an airplane which was spotting seals, this ice continued unbroken as far as could be seen.

FORTY-TWO SPEND WINTER ON THE ICE

There were 42 of us left to spend the winter on the ice.

We set to work at top speed finishing construction work and arranging our supplies, for winter would soon be upon us, and Antarctic winters are too cold to do much work outdoors.

I have described the general layout of Little America. It was a beautiful and eerie location. Out beyond the orange shacks, the tall wireless masts, resembling the spidery derricks in an oil field, and the spectral shapes of the anchored planes, were the vast stretches of the barrier. The long, sweeping lines of the hills were tinted with hues that constantly changed. Overwhelming solitude and a terrible stillness brooded over that immobile, frozen scene. Often we were shrouded in snow; soon we were to be cloaked in a long darkness.

Assembling the radio towers was a difficult task. It was done by Teddy Bayer and Jim Feury, neither of whom had done any ironwork before. They anchored the bases in ice, and devised scaffoldings to effect the bone-chilling, hand-freezing job of rearing the thin iron braces to 70-foot towers. These supported not only the antennæ, but also the cone-sheltered meteorological instruments. The versatility of the men was amazing.

On March 8 Gould flew to the Rockefeller Range to establish a base, examine land formations, and obtain specimens. He also intended to fix the position of the range by theodolite observations. This expedition was important. Landing a party on the range would prove that aviation could not only discover new areas, but could in some respects carry on a detailed study of them.

The same day four dog teams, designated the supporting party, left camp to lay down bases on the barrier toward the South Pole, in preparation for the geological party's trip to the mountains the following summer.

There were six men in the sledge party, with Walden in charge and Joe de Ganahl as navigator. Each team hauled 850 pounds of supplies. During the journey they weathered a 60-mile-an-hour gale, but men and dogs returned safely on March 13.

Meanwhile Gould, Bernt Balchen, and Harold June were still in the mountains. Bad weather held them in their tent for days. They were snug enough, but cramped in quarters, with barely room to turn around. There was no anxiety about them until radio communication suddenly ceased.

When two days of silence elapsed, I admit I was apprehensive. I knew they had finished their geological work and was afraid that they had crashed either at the take-off or else in flight, somewhere between the Rockefeller Range and Little America. It was then very late in the season—too late, in fact, to fly—and bitterly cold. We were anxious to get out to the mountains to investigate; but the weather was not good, and Bill Haines reported that we might have to wait many days before it would get better, if it improved at all before winter set in.

There was only one thing to do—go after them!

So, despite the fact the weather was dangerous for flying, with a slight drift blowing at the time and an extremely rough field, Hanson, Smith, and I decided to take off. We headed toward the southern part of the mountains, and on the way we could see heavy drift beneath us. It was gradually getting darker.

120-MILE GALE WRECKS "VIRGINIA"

Unfortunately, we were not certain, from the radio messages that came in, on what part of the mountains the party had landed, but we believed they were in a basin at the southern end. But we failed to sight them there. I had just tapped Smith on the shoulder to direct him to turn north when he exclaimed, pointing down, "There is a light!"

At least one of the three men must be up and about. We circled and rapidly approached the ice. In a moment I saw the

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DOCILE WEDDELL SEALS PAID LITTLE ATTENTION TO MEMBERS OF THE EXPEDITION

When disturbed, seals of this species frequently merely grunted, rolled over, and went to sleep again. However, another variety encountered in Antarctica, the crab-eater, proved mean-tempered and would attack a man.

plane *Virginia* wrecked on the snow. Were the other two men hurt? It was now very dark. The field seemed to be rough and furrowed and not particularly promising for a landing; but, in accordance with the predetermined plan, there was a landing "T" made of orange flags, which indicated that a landing was possible. Dean put the ship down perfectly.

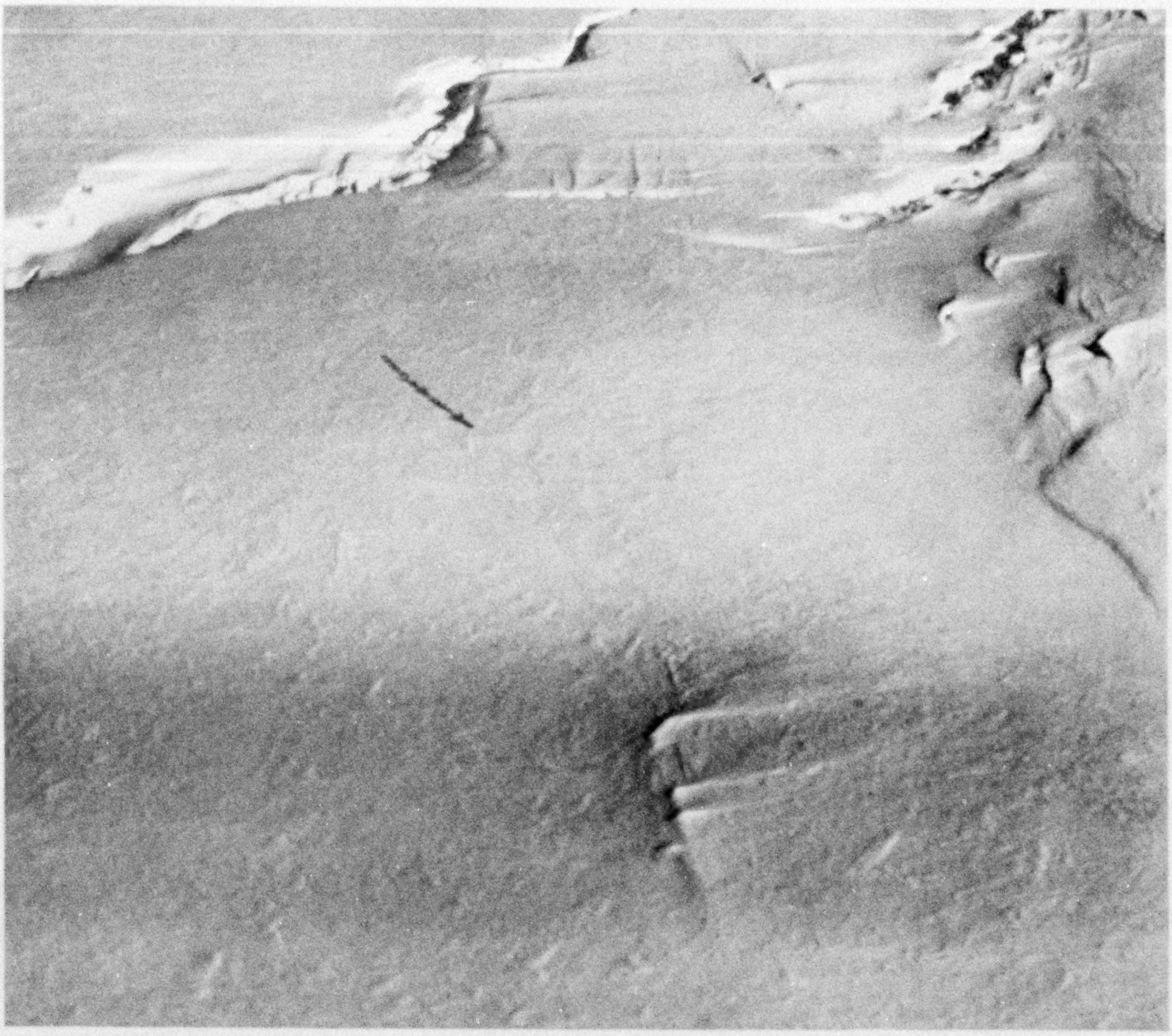
I got out of the plane and looked about anxiously. There was June. In a moment I saw Gould. Where was Bernt? Presently he came running from the tent. I cannot describe my relief. All three were well, but disconsolate after their battle with the terrific storm which had wrecked their plane.

The wind had risen to a speed in excess of 120 miles per hour. The three men, in an effort to anchor the ship, worked for hours in a gale which at times blew them straight out from the lines and pelted them with snow lumps from peaks two miles away. Finally a stronger gust tore the plane from its anchor lines, tossed it high in the air, carried it with uncanny stability for a mile, and dropped it, a splintered wreck, on glacier ice.

Balchen and June returned in the rescue plane. No one but a great pilot could have taken the plane back in the semidarkness as neatly as Dean did. Gould, Hanson, and I remained until the plane could fly back for us. We spent two cold nights in sleeping bags—the temperature was well under 25 degrees below. These were long days, for the winter was closing in rapidly. The third day the weather was clear enough for Dean Smith to come out for us.

From that experience we learned what Antarctic weather might do to airplanes. The only man who extracted much comfort from the adventure was "Cyclone" Haines, who averred we had made an important discovery—a new Antarctic storm area comparable to Adélie Land, where Mawson had reported such appalling storms, where the yearly average of the winds is 51 miles an hour and a gale blows the year round.

We buried our two remaining planes in houses of snow blocks for the winter.



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ACROSS LIMITLESS WASTES OF SNOW AND ICE, EXPLORERS FORCED A WAY

Not only from the air was the conquest of Antarctica attempted; sledge parties also made remarkable journeys. Near the center of the illustration is seen a party traversing a crevassed region in the vicinity of the Bay of Whales.

On April 1 the thermometer dropped to 47 degrees below zero. The men kept on with their work, digging communication tunnels and bringing in the material we had taken on the barrier from the *Bolling*. It was a colossal and frigid job. The snow had almost completely covered the cache. When we finished the tunnels we had more than a quarter of a mile of these subways, so that we could move from shack to shack and reach our pile of seal meat without subjecting ourselves to the cold, which would instantly freeze any exposed human surface. We dug similar trenches to shelter our dogs.

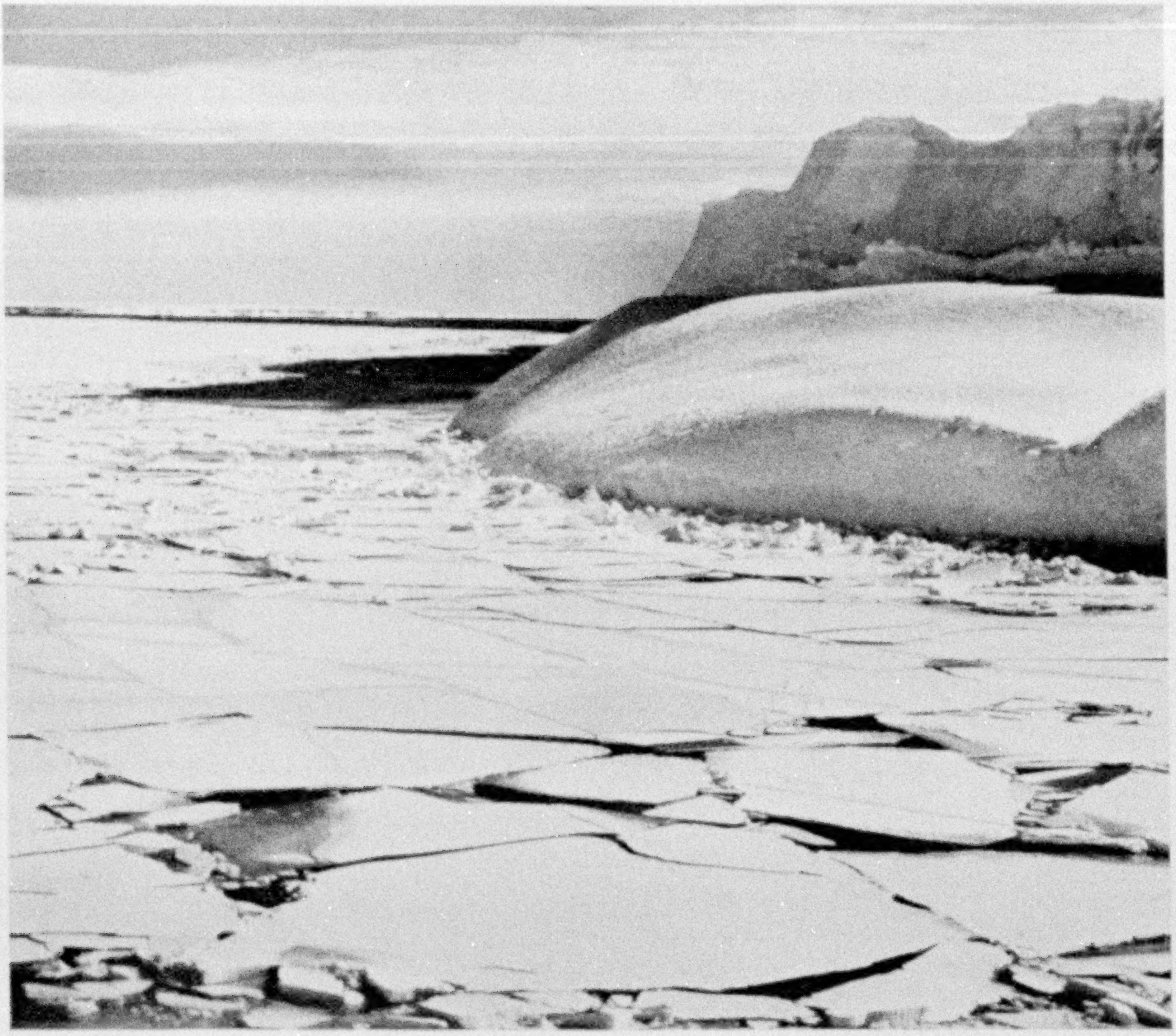
THE SUN SAYS GOOD-BYE FOR MONTHS

Our gasoline engines generated electricity for radio and lighting, as well as for the sunlight treatment the men took occasionally.

The sun bade us good-bye April 18. The day before, it crawled along the horizon, a round ball of smoldering fire, and slowly slid out of sight. It was August before it again was visible from our hollow. The long, fading twilight set in, the cold intensified.

TALKING WITH GREENLAND

National Geographic readers have listened in to the fine entertainment programs sent us by radio during those winter months, but home folk scarcely can realize how much they meant to our morale during our most trying time—the months of waiting in the dark. I have spoken of KDKA. WGY was the other station that



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PACK ICE PRESSES ABOUT A BERG

Huge blocks of floating ice press upon each other and sometimes overlap to form a rough and dangerous surface. It is not passable afoot, but a sturdy ship may force its way through.

broadcast to us. Their programs were splendid, and we seldom failed to hear them.

One of our remarkable radio experiences was that of talking with the University of Michigan Meteorological Station at Mount Evans, Greenland. Petersen got the greatest kick out of this chat between the world's two biggest ice sheets. He compared our aurora with Greenland's sunshine, communicating in Norwegian with the radio operator at Mount Evans.

Day by day Russell Owen filed a complete report of our activities to the *New York Times*. He did a splendid job on a unique assignment. For the first time the day-by-day account of an Antarctic expedition was "covered" like any other news event. I was willing that this should be done, because I feel that his work went far toward making the world realize the great opportunities for exploration and scientific study which the Antarctic holds. I am delighted with the award to him of the Pulitzer Prize for the most outstanding news reporting of the year—an award his accuracy, diligence, and alertness so richly deserve.

Trying, those months were, but far from idle or profitless. Some of our most valuable scientific data are the daily records made by Haines and Harrison of temperatures, barometric pressure, wind direction and velocity. We made observations of ice conditions and posted a night watchman to record that weird spectacle, the aurora australis, which corresponds to the aurora borealis in the Arctic. All winter Frank Davies continued magnetic observations with his many sensitive recording instru-

Photograph courtesy Paramount Publix Corp.

STARTING IN EARLY TO LEARN THEIR TRADE

Many puppies were born at Little America and some of the expedition members brought back young dogs as mascots. These little fellows were only a few days old when George Black, one of the supply officers, harnessed them to a tiny sledge.

ments. Hanson, on the barrier, and Berkner, in New Zealand, carried on radio experiments.

LIVING LIKE A FAMILY OF MOLES

As the cold and darkness increased, our whole existence changed. We became a family of moles, scuttling through glistening snow tunnels with lanterns and flashlights. We emerged only for short walks or tasks which had to be done.

One o'clock, any morning, the watchman, in furs, his parka hood over his head, throws more coal in the library stove, the only stove kept going during the sleeping hours. In the other room is a row of double wooden bunks, each holding a huddled figure in a sleeping bag, head drawn under like that of a turtle.

Every half hour the lone watchman must duck out in the bitter cold. The aurora is painting its freakish, gyrating pictures across a dead sky. He notes the clouds, he checks each thermometer and thermograph to make sure the cold has not stopped the recording mechanisms. At 6 o'clock he makes the fire in the kitchen stove, which is on one side of the mess hall, opposite the bunks.

The clock strikes a high-pitched note, for the cold affects the bell, and the watchman "signs off" by calling Larry Gould. Gould's job is to get everyone up for breakfast. The men call him Simon Legree. But they appreciate that lying in bed is bad for morale. Our main winter job is keeping happy, and the way to keep happy under these conditions is to keep busy. We allowed no one to stay in bed. I believe that if a man does not keep strict routine during the long night his mind is almost certain to get kinky.

CREVASSE INVESTIGATED AT 50 BELOW ZERO

For weeks we had been intensely interested in a crevasse north of the camp. Gradually it had widened. Was this because of cold weather contraction or from barrier movement? One day late in April it was only 50 degrees below zero and the wind was light, so we decided to have a look at it.

Photograph courtesy Paramount Publix Corp.

ONE OF ANTARCTICA'S NATIVE SONS PAYS HIS RESPECTS TO A DOG TEAM

The little Adélie penguins seem not to know fear. Sometimes they approached so close to the dogs that they served themselves up for lunch. One creature to whom they do give a wide berth, however, is the killer whale. A group of these strange birds will stand on the ice for some time peering into the water in search of their enemies. Finally one will get a bit too near the edge and his companions will push him in. If he swims about without molestation, they all go in; if he is eaten by whale or sea leopard, his brethren restrain their desire to enter the water.

We alternately searched for a feasible entry point and for frozen spots on each other's faces. When a mitten was removed to rub a freezing countenance the hand froze. Strom froze his left big toe and ran to the nearest house to thaw it out. Dr. Coman went running back to quarters to get on more clothes. His hands were nipped.

We could not use hand flashlights because the cold stopped chemical action of the dry batteries. We provided light by linking a portable gasoline engine generator to a locomotive-type searchlight pointed down the dark fissure.

I had Strom tie a rope around me, another was looped to my feet for a signal, and the men lowered me into the crevasse. It was bumpy going because the aperture did not extend straight down.

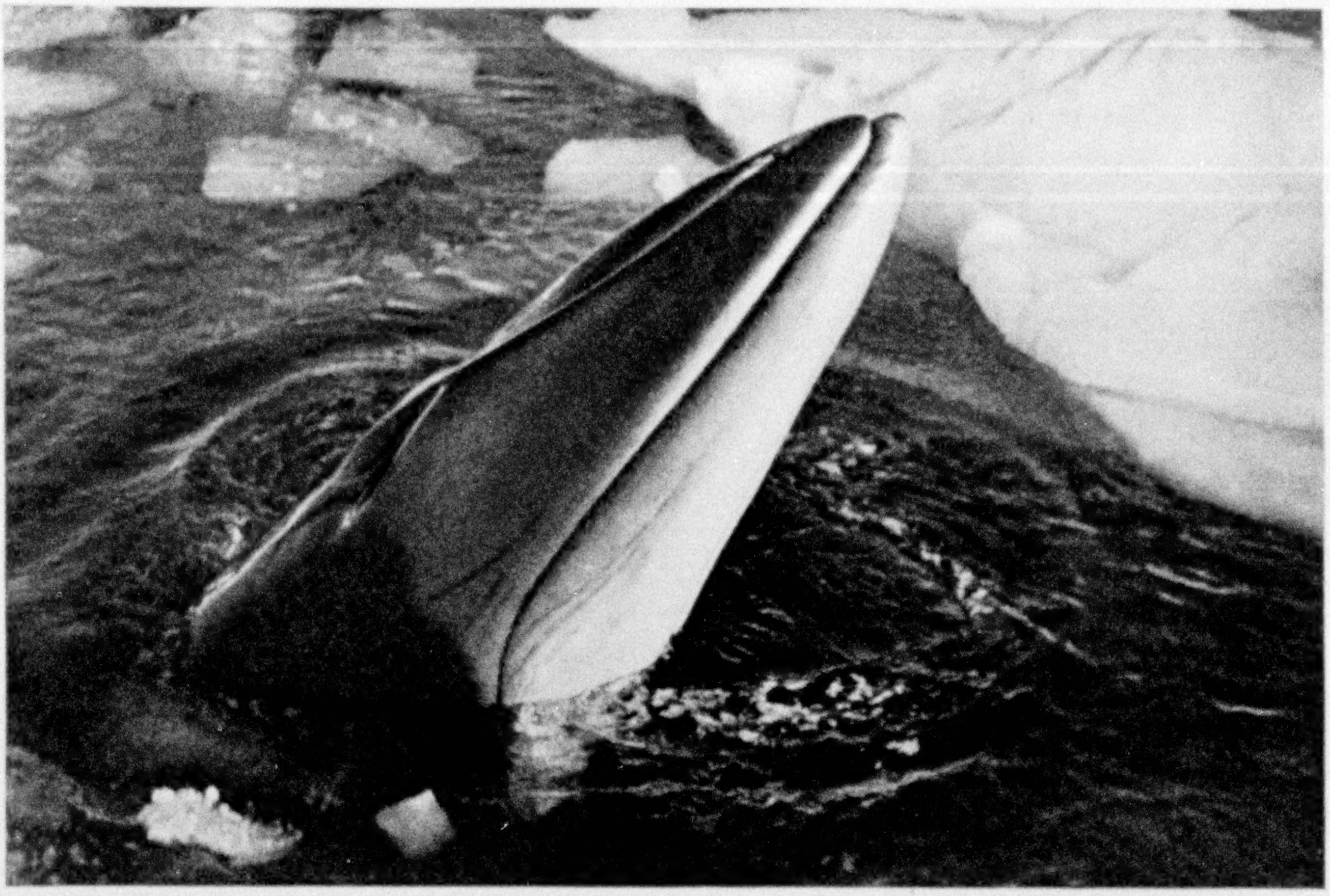
At bottom I was in a sort of grotto formed by the contracted barrier ice. I smashed through this with a crowbar until I reached slush. I tasted it and it was salt. We had long wondered if sea water filled these crevasses at sea level.

It was warmer down there, 18° below as compared with 50° below at the surface. On the way up I gathered some ice crystals, of a size and perfection that I had never before seen.

Next day the thermometer went to 58 below zero.

Several men walked outside for an hour or so at least once every 24 hours during the long winter night.

We found we could walk considerable distances at 50 or more below, in a 20-mile wind, and not suffer if the wind could be kept from the face. So we devised face masks to protect the nose and cheeks. These got wet from condensation and froze, but so long as they did not touch the skin they served as a shield. The most



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A FINBACK WHALE COMES UP TO INVESTIGATE

Note the blowhole on top of his head. Through this he breathes, and when a breath is coming out it is pleasanter to be on the windward side.

effective face protection was made in the shape of a baseball mask with a kind of funnel leading to the mouth and fitting snugly around it, so that the breath could be led outside the mouth and not quickly become a hunk of ice.

It was amazing to see fogs at these temperatures. The air holds a very small amount of moisture at 50 below, but when the wind stirs the warmer and colder air condensation of this minute amount of moisture occurs and a real fog is evolved.

FANTASTIC EFFECTS OF CONDENSATION

Unexpected warm weather struck us toward the middle of June—unexpected because that was Antarctic midwinter—and the moisture of temperatures of only 8 to 11 below zero created such marvelous ice and frost crystals that the photographers took flashlight pictures, using flares which lighted up the houses, radio towers, and frosted antennæ.

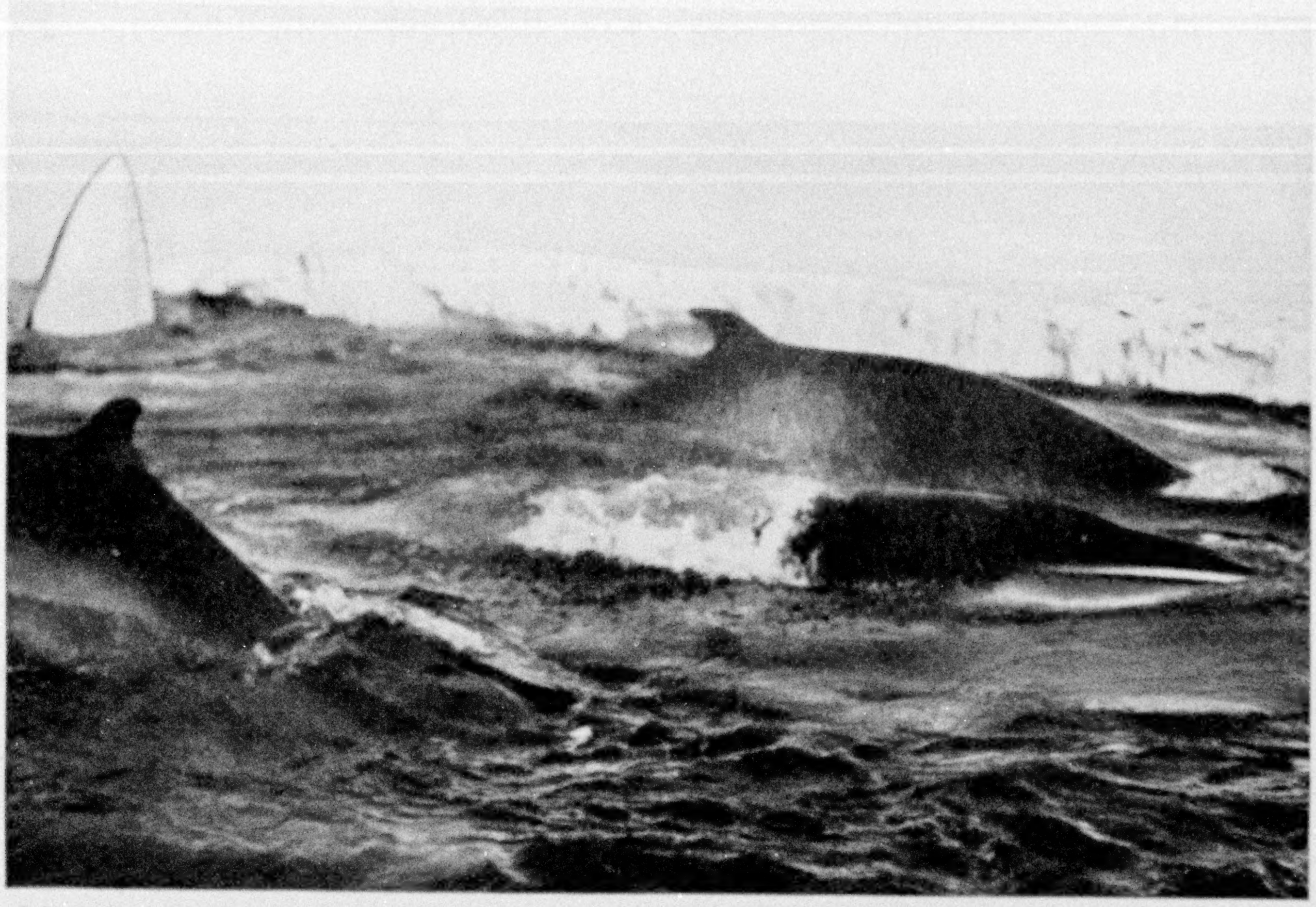
No photographers, I am convinced, ever exercised such ingenuity or overcame such constant difficulties as ours experienced.

The unequal contraction of steel, brass, and aluminum caused binding, stiffening, and bending, so that the cameras had to be taken apart again and again. Every time they were brought indoors it was necessary to wipe and bake them, or hang them above the stove to dry, so that no moisture remained to freeze when they were taken outside.

The incredible condensation in the Antarctic cold affected cameras and all our scientific apparatus. Even a book lying against a cold wall steamed like a tea kettle when opened in a slightly warmer atmosphere. When a man stood inside the entrance to one of the house tunnels, the vapor formed by his breathing was so heavy the house appeared to be on fire.

The automatic cameras quit at 20° below because the cold contracted the springs, which bind. We found we could warm an automatic over a primus stove, carry it under a parka next to the body, and it would work for about an hour. That is how we made "movies" of the Rockefeller Range.

Motion-picture film began to snap at 25° below. It had to be rethreaded with bare hands because of the small space. Care had to be taken not to breathe into the camera, because then frost formed on



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"PIG WHALES" MAY BE A NEW SPECIES

These comparatively small sea mammals have not yet been positively identified scientifically. They have much in common with the widely distributed pike whale, but certain points of difference may entitle them to a classification of their own.

the instrument. Fingers stuck to metal parts, and after that operation I have seen the photographers hop about in pain, holding their hands under their armpits.

Hardest of all were the blizzard pictures. When the camera faced the wind, snow gathered on the lens; if turned away, eddies sucked the snow in almost as fast.

We had been hearing about New York's heat wave when, on July 3, our thermometer dropped to 64 degrees below zero. It was so cold that when a man stood outside the tunnel he could hear his breath freeze. The condensation caused a faint swishing sound like snow blown across the ice surface by a strong wind. The corners of my room near the floor were never free from ice.

KEROSENE FREEZES SOLID

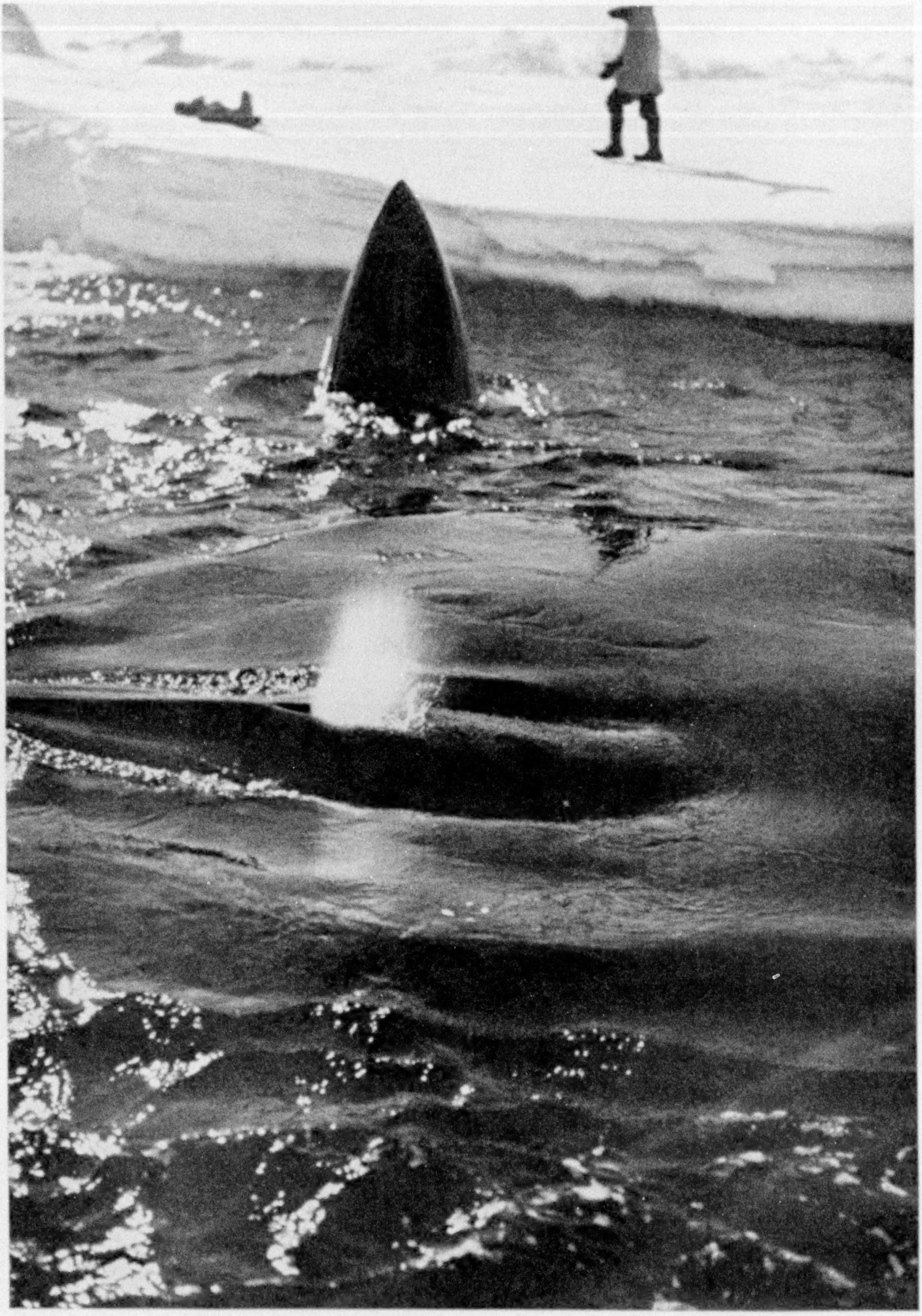
At home kerosene is used to keep automobile radiators from freezing; down there, cans left too near the entrance of the snow tunnels froze solid. Ventilators left open poured forth vapor like the exhaust of a steam engine. Cans of tobacco brought out from beneath our bunks were so frosted they might have been left out in a snowstorm.

That cold spell persisted for two weeks. One mid-July day the mercury touched 71° below zero. That caused the barrier snow to contract sharply. All about us we could hear the ice snapping and cracking. Then, as large cracks occurred, the bay ice began booming like distant guns. The guy wires on the antenna posts became as taut as harp strings and the wind played odd humming tunes on them. We had to warm the candles we used under the meteorological balloons before they would burn.

An observation in low temperatures was made when a balloon was sent up one day and registered 70 degrees below zero.

On another cold day Hanson took a trip ten miles out on the barrier and stayed 48 hours to make measurements of the Kennelly-Heaviside layer, which affects radio waves. Plans for this work had been made at the Naval Research Laboratory in Washington before we left the States.

The first time Hanson started the dogs' noses froze and the trip had to be postponed. It was then 60° below.



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WHALES CAUGHT IN A CLOSED LEAD OF THE BAY ICE

The one in the foreground is registering a sigh, while the other is standing on his tail, presumably looking for more open sea, although whales are not noted for good eyesight out of the water (see, also, illustrations, pages 143, 176, and 177).

The weather abated and Hanson, along with De Ganahl and Vaughan, started again in charge of four dogs. Vaughan hitched himself ahead of his dogs and pulled on skis with them all the way out and back. All three men traveled on skis and, because of the darkness, took many tumbles.

On the sled were 600 pounds of apparatus, tents, food, and emergency supplies. Hanson packed his precious oscillograph on his back lest it be injured if the sled tipped over. Inside his shirt, so they would not freeze, he carried dry batteries.

When he had set up a tent and made ready for 24 hours of hourly observations he got into communication with Petersen. A synchronous contracter had been rigged up in the base radio room, so Petersen could send out short impulses at the rate of 180 a second and six a second, alternately.

During 36 hours Hanson took oscillograms and photographs of the queer things that happened to the waves and obtained about 150 recordings, which show extraordinary variations in short-wave signals. Conditions here affect all short-wave sending which traverses Antarctica; hence this data should be of value to radio communication when it is compiled and compared with sunlight transmission.

DATA ON TERRESTRIAL MAGNETISM

Another important subject of scientific study was that of terrestrial magnetism, the lines of force which make our earth a planetary magnet, affect the compasses of every vessel that sails the seas, and now bear down upon our daily lives because of their influence on radio reception.

Many stations already are recording magnetism data. Valuable information was amassed by the ill-fated nonmagnetic ship, the *Carnegie*, but the Polar regions yield the best results and have been least studied. Magnetic storms are most intense and frequent in the Antarctic.

Little America, 792 miles from the South Geographic Pole and 820 miles from the South Magnetic Pole (the latter in South Victoria Land, latitude 72° 25′ south) was an ideal location for magnetic observation.

Moreover, in addition to storms and seasonal variations, terrestrial magnetism runs through a cycle of sun-spot changes every eleven years. Previous Antarctic studies had been made in years where sun spots were at a minimum. We were in the Antarctic near a time of maximum sun-spot frequency.

Our physicist, Frank T. Davies, established a nonmagnetic hut well away from the radio towers, south of our main tunnel. All iron was removed from timbers, only brass and copper nails were used.

The hut had to be dark, as the recording apparatus is photographic. A hole deep enough to swallow the hut was dug and snow was packed around it evenly, a foot deep over the roof.

Therein were installed the magnetic and electrical instruments provided by the Carnegie Institution of Washington.

Two of the instruments had a history. The magnetometer was used by Amundsen and Sverdrup on the *Maud* expedition, and here it met an old friend in Martin Ronne, who was on the *Maud*. The theodolite belonged to W. J. Peters, scientific leader of the Ziegler Polar Expedition, and was used by him in Franz Josef Land.

PREPARING FOR A COLOSSAL TASK

While we made all possible records and observations, we had a colossal task during these winter months preparing for the 1,300-mile journey afoot our geological party was to make, the trip of the supporting party, and our flight to the South Pole.

These projects demanded infinite care in planning. The geological party might be away from base for three months. Every possible contingency must be provided for before the start. If the men were to get back safely, every plan must carry through; and to do that every bit of food and equipment must be just right.

Our flight to the Pole involved unprecedented features, far surpassing the exigencies of a simple flight of 800 miles inland and back. For hundreds of miles we would fly over a barren, rolling surface; then climb a mountain rampart 14,000 feet high, with a 10,500-foot pass, and continue our journey across a 10,000-foot plateau.

Factors of speed, horsepower, rate of climb, and other engineering problems entailed endless hours of complicated calculations. I don't think I ever before saw so many pages covered with figures.

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MUSHING ACROSS BAY ICE TO MAKE MOTION PICTURES OF KILLER WHALES

The first official showing of the motion-picture record of the Byrd Antarctic Expedition took place before a distinguished audience of more than 6,000 members of the National Geographic Society, in the Washington Auditorium, on the evening of June 20, 1930 (see, also, pages 228 to 238).

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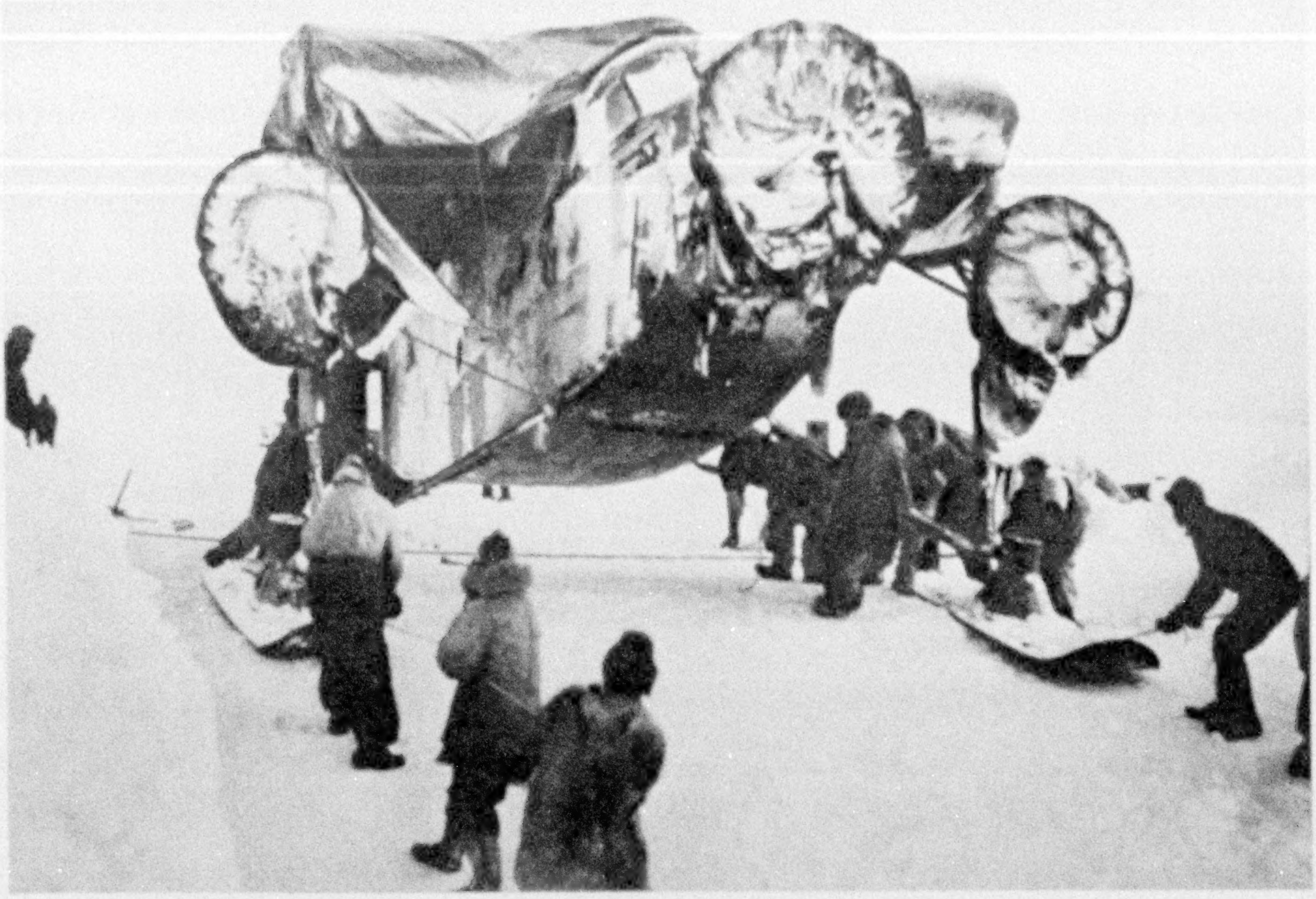
ICE TONGUES FRINGE A LAKE IN KING EDWARD VII LAND (SEE TEXT, PAGE 220)

Capt. Ashley C. McKinley, who mapped many thousands of square miles from the air, also made some of the aërial views which appear in gravure (pages 159 to 166 and 199 to 206). For the gravure illustrations as well as for many other photographs reproduced in this issue of its Magazine, the National Geographic Society desires to express its appreciation to the *New York Times* and the *St. Louis Post Dispatch* for their valuable coöperation and courtesy.



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WINGS CLIPPED FOR THE WINTER

The Ford plane, with "overcoats" on its motors and folded wings, is being skied into its snow hangar to hibernate through the months of darkness.

There also were questions of route and bases, all weather possibilities, location of refueling bases, take-off loads, navigation, and scores of other problems.

Then, too, there were matters of food and clothing for all three parties—tents, dogs, personnel, each with amazing ramifications, considerations to be balanced one against the other.

It was fortunate for us that we took with us a splendidly equipped machine shop. Victor H. Czegka, master technical sergeant of the Marine Corps, ruled over this part of the camp. Some months before the expedition began Czegka wrote to me (it was a lucky day for the expedition) that he was coming along with us. It was he who selected the machine shop. He is an artist in metals. With June assisting him, many necessary items of equipment were invented and improvised. For example, they built entirely new cookers for the trail.

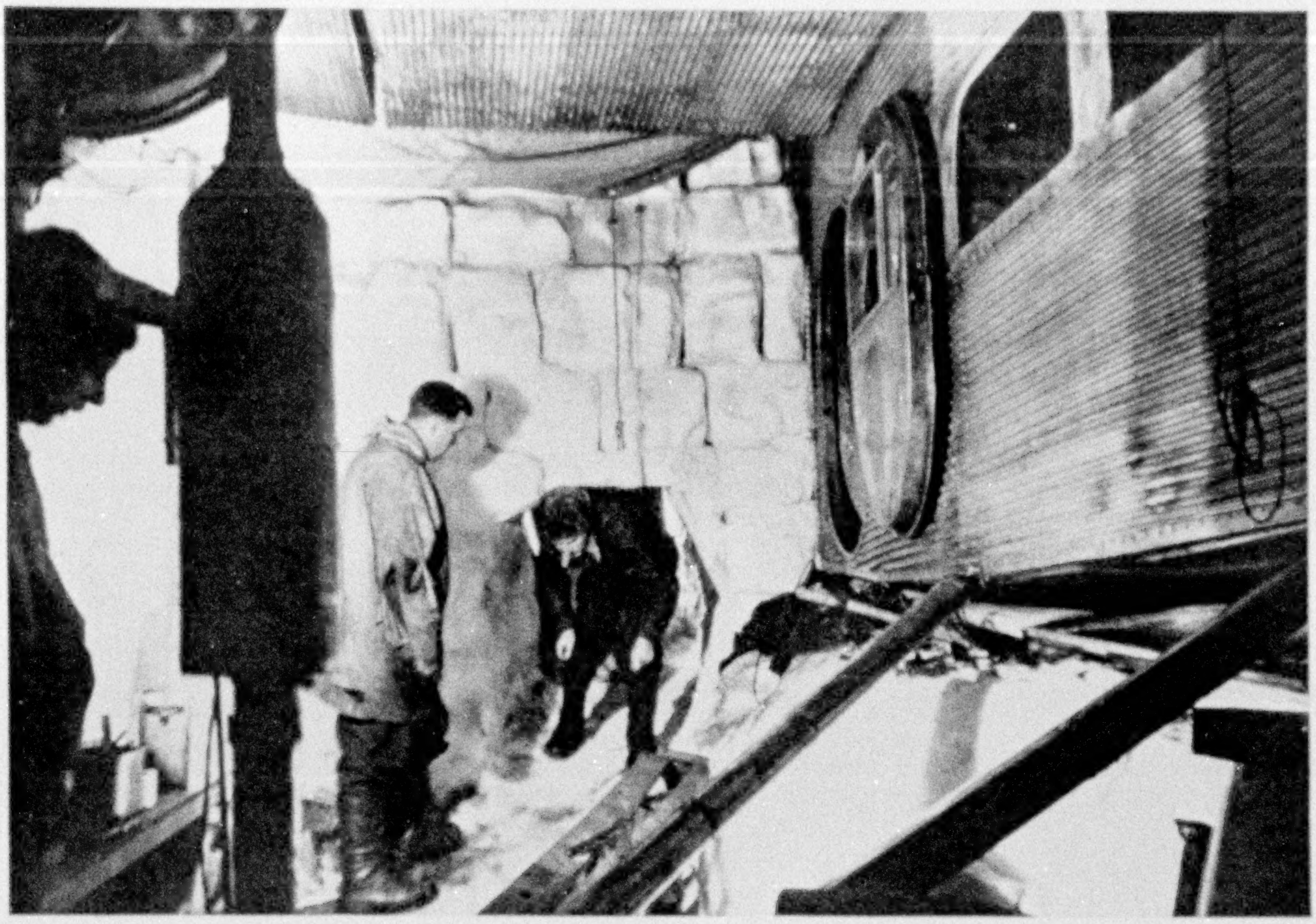
Czegka invented and made a sounding apparatus. He made and attached some cogwheels to our outboard motor-boat engine, so that the great meteorological kites could be pulled down in a strong breeze. Stands were made for trail parties' sextants. There seemed to be nothing the machine shop could not turn out. Czegka even made a delicate accuracy navigational instrument that De Ganahl devised.

Almost everyone in camp devised something useful.

We made lamps from preserve jars, reflectors for the gasoline lamps, so that one lamp lighted up a whole room; snow-melting outfit; sink for the kitchen, blubber stoves made out of gasoline drums and oil cans; flashlights from cigarette cans, etc. The radio engineers made all radio sets for the trail and plane and emergency sets for use in case of forced landing. The brunt of this radio work fell on Howard Mason, who was helped by Petersen and Hanson.

INTERNATIONAL WELCOME TO RETURNING SUN

The twilight of early August, harbinger of the slow-ascending sun, sped our preparations. On August 20 some of the men climbed the radio towers for a preview of the sun. The flaming disk, still riding the



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INSIDE THE "FLOYD BENNETT'S" SNOW HANGAR

horizon like a fiery wheel, was magnified tremendously by refraction.

It actually rose, to the surface observer, August 24, and we made a ceremony of its coming by unfurling the Stars and Stripes, and then the British and the Norwegian flags. This was in honor of our predecessors, Scott, Amundsen, Shackleton, and Mawson, and their comrades.

But the most vociferous tribute to Old Sol was heard when we dug the snow from the roofs of the dog tunnels, opened the ventilators, and there poured forth a wild medley of barks and howls.

For several weeks we had been thrilled by the daily reports from Dr. Hugo Eckener's flight around the world. We followed especially his progress across barren Siberia; perhaps we had a fellow feeling for aërial navigators in waste places. On August 29 our radio station got in direct communication with the *Graf Zeppelin* and Petersen chatted in code with the airship's operator while it was crossing Pennsylvania.

September and sunlight brought slight relief from the cold. August 31 to September 4, inclusive, developed temperatures of 40 below, 60 below, 66 below, 63 below and 48 below, respectively. When our thermometer touched 63 below we inquired about New York's temperature. It was 94 above there, a difference of 157 degrees. The human organism is marvelously adaptable!

September went out with a blizzard, and when we checked up we found the September average was 44 below zero, ten degrees colder than Amundsen's average for the same month. Our August average was 27.8 below; Amundsen's was 48.6, more than 20 degrees below ours. In July we recorded a 44.7 average, whereas Amundsen's average was only 33.7.

SLEDGES FOR THE GEOLOGICAL PARTY

In this cold we worked away making and repairing sledges, packing supplies and instruments for the dog-team trips south of the geological party and the supporting unit. Ronne devised mits and woolen parkas from blankets; he made dozens of windproof parkas, pants, socks, shirts, and gloves. We had many different types of tents with us, and we studied tents used by Polar explorers and finally devised our

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"ENGINE FOOD" WAS STORED IN A TUNNEL OF ITS OWN

Gasoline and kerosene drums were placed on the edge of a fairly deep trench roofed over with canvas. Drift snow soon covered this and made a weatherproof compartment. This fuel tunnel was connected with the main "undersnow" passage, running between the principal buildings, so that supplies might be drawn without going into the open.

own type of trail and plane tents. These were especially light, strong, roomy, and windproof.

First to leave the base was the supporting party, which was to go halfway to the mountains and there deposit a large supply of food to be picked up by the geological party, which would follow them.

The first party relieved the geological party of carrying loads which would have weakened the dogs and cut short the scientific work. This party laid food at depots about 50 miles apart and made a trail to insure greater safety through the dangerous region of crevasses.

The geological party followed the trail to 81° 45′ south, laid more depots along the Grosvenor Trail, and established a base at the foot of the mountains.

This base was the headquarters of the geological party while working in the mountains, and also was designed as an emergency airplane base for our surveying flight to the South Pole.

Our trail lay in a straight line to Axel Heiberg Glacier, a little to the east of Amundsen's path. We named it the Gilbert Grosvenor Trail for the President of the National Geographic Society, and we named our meteorological station, so essential to the sledge parties and flight, for Dr. John Oliver La Gorce, Vice-President of The Society which helped us so materially with financial support, scientific advice, and unwavering faith in our project.

THE LEADER ON SKIS

On October 15, 1929, a line of dog sledges started across the first slope of the barrier south of the Bay of Whales.

The rolling plain of snow, leading into that vast ice wilderness, was tinted in soft rose traversed by purple shadows. The sun flamed above the western horizon; in the eastern sky rode the ghostlike moon.

Ahead of the sledges was a man on skis. When the going turned rough, he fastened a rope to one of the men who followed

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DIGGING THE POLAR PLANE OUT OF ITS WINTER QUARTERS

The ship had hibernated in a pit dug in the snow and roofed with canvas and drifted snow. Getting it in and out of this improvised hangar was one of the most laborious tasks the men had to perform (see, also, text, page 191).

him. The leader watched for crevasses and set a straight course, guided by shouts from the navigator, who always kept an eye on his compass. The dogs travel straighter when some one is ahead of them.

Beside the dog teams ran the drivers, also on skis. The low sledges were curved at each end and teamed in pairs to distribute their weight. Loads were packed in rectangular containers called tanks, lashed securely to the sledges. These tanks kept out the snow, and when a sled turned over it could be righted with its load in place.

Every half mile the navigator planted an orange flag, attached to a bamboo pole, to mark the trail for those who followed. Orange was found after tests to show up better against the snow than any other color. The navigator constantly checked his course and also recorded the distances traveled by means of the sledge meter, a wheel running behind a sledge which ticked off the mileage on a dial. With a trail carefully marked, the risk was lessened and time saved on the return journey (see page 208).

At the halts, noon and night, snow beacons were erected and flags placed on top.

Arthur Walden handled a dog team and was leader of the first party out. Joe de Ganahl was navigator, radio operator, and cook. Chris Braathen and Jacob Bursey handled the dog teams.

Men and dogs steamed in the cold wind. We must not forget the dogs. They struggled along almost flat on their bellies with their heavy pull, their tongues hanging out. The men pulled, too, straining every muscle and whipping every nerve to keep going at the most exhausting job I know. Every half hour a stop for brief respite; then on again, slowly, painfully. It was bitterly cold then. It is not generally known that the colder it is the more difficult the pulling becomes. At 50 below the snow acts like sand on the runners.

Runners broke through the crust, then encountered hard snow, which had to be crushed. Beneath that layer the granular, sandlike snow braked the sledge runners. Sledges toppled over and were righted. Men would ski over a slight jump; then

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PEERING DOWN THROUGH THE CLOUDS AT A NEW BAY

The recent formation of this bay is apparent from the absence of a runway of snow, which accumulates along the barrier edge when bay ice is present for any length of time. A huge piece of the barrier has broken away here.

the skis would stick fast and pitch the men forward on their faces.

The first day, nine miles; the second, ten miles; the third, only seven.

THE "GREEN FLASH" FLARES AT SUNSET

Back at camp we saw the "green flash." This phenomenon usually occurs in the Tropics, where the sun drops so suddenly below the horizon. Atmospheric refraction causes the light to disappear in the order of the refrangibility of the rays. Red rays bend least, so disappear first; then the green; finally the blue.

Here the downward movement of the sun is prolonged; the last rays shimmer above the barrier edge as it moves eastward, appearing and reappearing from behind the barrier surface.

Hence we had a series of sunsets. The "green sun," as our men called it, lasted 35 minutes. This gave us a rare opportunity to observe a phenomenon which is partly physiological—look at a red object too long and you will see its "fatigue opposite," bright green—and partly due to the Antarctic atmospheric conditions, which preserve the greens, blues, and successive colors at the violet end of the spectrum.

When our first party was well advanced toward the mountains, the geological party, with five dog teams, carried out loads about 100 miles and returned in 8½ days. The pulling had been very hard and the party was a trifle pessimistic as to the ability of the dogs to do the job as we planned it. But we need not have wor-

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LEVIATHAN OF THE SOUTHERN SEAS IGNORES THE INTRUSION OF MAN

The members of Admiral Byrd's ice party might as well not have existed, for all the attention the finback whales paid them. Only the killers, vicious sea wolves, attracted to any living thing, took note of the explorers (see text, page 155).

ried; the endurance of Eskimo dogs is amazing.

OVER TREMBLING ROOFS OF BLACK CREVASSES

We waited with anxiety news of the supporting party's adventures in the hilly, crevassed region near Depot No. 4, about 200 miles out. Amundsen described how, on his return trip, this area, which he called "The Trap," was pitted with yawning chasms deep enough to swallow his whole party, and treacherous holes concealed behind ridges.

Our men, lashed together with ropes, were prepared to pick their way through these pitfalls. They were prepared to pull out sledges with alpine ropes if they should crash into a gaping abyss.

On October 29 De Ganahl radioed us: "From latitude 81 southward this morning a long line of knolls, jagged peaks, and rolling domes glistened on the crest of a hilltop stretching east and west.

"We had gone five miles when Bursey, who was leading the roped caravan, swung his sled to a halt. His dogs were on the roof of a round hollow pit 50 feet in diameter.

"Well-roped, we planned a reconnaissance on foot. Soon crevasses, some open, most of them roofed, lay across our path.

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CAPTAIN MCKINLEY USES A COMRADE FOR A TRIPOD

This big camera, primarily designed for taking air views, holds a film roll 75 feet long, containing 110 exposures. When weather conditions permitted flying in the Antarctic, they were usually favorable for aërial photography, although the pale sky and vast expanses of snow sometimes made the skyline indistinct.

"Walden stepped away from his sled, landed in a crevasse, and sank to his waist. He was pulled out and in a few minutes went down into a second pitfall.

"We proceeded with the teams. In five minutes we were shut in by hollow domes, every step on a thin, trembling roof. We crossed a safe-looking ridge and slid down ten feet from an open hole with blackness for a bottom and turned the teams to the west."

This is a conservative description of part of the crevassed areas. Is it any wonder I was apprehensive when the teams entered this area? The radio may make for efficiency, but it also adds greatly to the worries of a leader whose units are widely scattered.

After passing the crevassed area the supporting party reached its destination November 1, at 81° 45′ south, where it laid down the last of its supplies at Depot No. 4 and turned homeward.

Three days later the geological party, led by Dr. Gould, started on its 400-mile trip to the Queen Maud Mountains, at the edge of the Polar Plateau.

SECRETS OF THE ANTARCTIC SPHINX

Our most careful planning, with infinite attention to detail, had been expended upon this expedition. Every man had turned to during the winter to help the trail parties. This one would be away three months; it would spend nearly a month in surveys and collecting data on one of the most important and least-known areas of Antarctica; it was one of our major scientific projects. In fact, it was one of the most important geological missions left to do in the world.

Dr. Gould planned first to examine the exposed sides of Mount Nansen, which towers nearly 15,000 feet above the barrier. This and adjacent mountains might show whether the barrier basin had been formed by a fault which depressed the enormous area now covered by ice. Dr. Gould might learn whether the Queen Maud Range was an extension of the ranges from South Victoria Land. He

intended to look for fossils that might throw light on the preglacial era. Coal beds and fossils previously found in Antarctica indicated that vegetation once flourished there, perhaps when our own New England was buried under an ice sheet.

Gould's face showed his joy at getting into geological action. Norman Vaughan, powerfully built, was muffled in a woolen parka under a windproof until he looked bigger than he was. Fred Crockett, youngest of the drivers, exhibited a broad grin under green goggles fixed to a green knitted helmet. Eddie Goodale, tall, slender, and serene; Mike Thorne, lithe and hard, and Jack O'Brien, wearing a shade that made him look like a jockey, completed the party.

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CREVASSES OFFERED SERIOUS OBSTACLES TO SURFACE TRAVEL

These deep trenches in the mass of snow and ice were frequently 20 to 30 feet across. The trail party had to detour many miles to avoid this one. They are most dangerous when covered with a thin layer of snow, which looks solid but will not sustain much weight.

The expedition owes a great debt to the dog men. I wish to speak especially of Walden, Jack Bursey, Joe de Ganahl, Mike Thorne, Chris Braathen, Quin Blackburn, and the "Three Musketeers"—Vaughan, Goodale, Crockett—who spent many months training in preparation for this gruelling work.

EVERY OUNCE OF EQUIPMENT COUNTED

The dogs were harnessed after luncheon. They strained at their picket ropes, snapped at each other, and plunged in their traces in mad excitement.

The drivers used the Alaskan gang hitch—that is, the dogs were harnessed to each side of a long line attached to the sledge. One dog is attached to the end of the gang line as leader, and to him the drivers yell their commands of "Gee" or "Haw."

When properly conditioned, dogs will stand a great deal of exposure, though at very low temperatures they quickly become exhausted, as do other living things. Our dogs had slept outdoors at 50 below zero and had developed marked resistance to cold.

The total load carried by the ten sledges of the geological expedition was 5,368 pounds 14 ounces. Every item of equipment was weighed and every ounce not

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SKIS AND CATERPILLARS HELPED THE SNOWMOBILE TO NAVIGATE

The motor-driven vehicle went 80 miles south of Little America; then broke down. It took the three men several days to walk 80 miles back to camp. On the first sledge are planks that served as emergency bridges to enable the machine to cross narrow crevasses.

essential to health and safety of men and dogs and the scientific work was eliminated.

Among the items were: personal equipment, 355 pounds 2 ounces; man food, 1,221 pounds 10 ounces; camp gear and fuel, 331 pounds 5 ounces; dog food, 2,674 pounds; dog gear, 58 pounds; extra sledge equipment, 12 pounds 4 ounces; navigation, surveying, and meteorological equipment, 91 pounds; skis, 27 pounds 12 ounces; trail markers, 173 pounds 8 ounces; motion-picture equipment, 65 pounds 2 ounces; still camera equipment, 18 pounds 5 ounces; radio gear, 300 pounds; safety devices, 40 pounds 9 ounces; tools, 20 pounds 5 ounces.

During the winter the dog-team men labored getting each day's rations into little separate bags, so that no time would be lost on the trail getting rations together. Each man was allowed about 34 ounces per day.

The loads were distributed between the two sleds of a team so the heaviest, of about 800 pounds, was on the forward sled, and about 300 pounds on the rear sled. This distribution increased the safety factor in crossing snow-bridged crevasses.

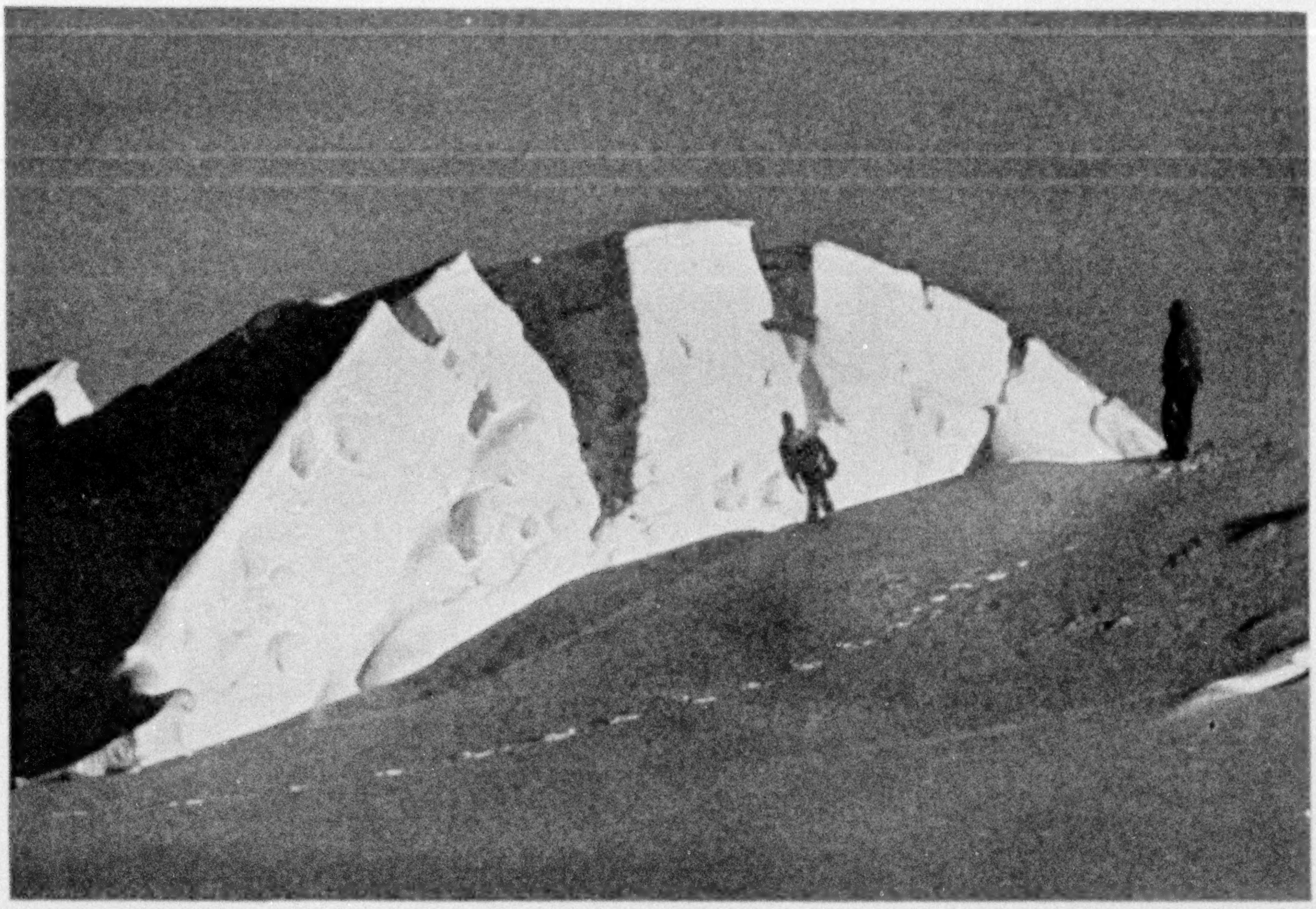
It must be remembered that supplies, especially dog food, had been deposited at the first four depots.

FOOD SCIENTIFICALLY COMPUTED

Our food supplies included pemmican, made in Denmark, biscuits, butter, peanut butter, bacon, concentrated soup, oatmeal, sugar, powdered milk, cocoa, malted milk, tea, salt, and chocolate. A lemon powder containing the important vitamin C was carried for its anti-scorbutic properties. Scurvy has taken a heavy toll in the Polar regions and Dr. Coman deserves the credit for preventing it.

Meals on the trail were cooked on a Nansen-Czegka cooker, which is built around a two-burner primus stove that burns gasoline.

The dog food on the trail was pemmican compounded from a formula worked out at Otago University, New Zealand, by Dr. Malcolm. It was packed in cakes which



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PRESSURE RIDGES IMPOSED MANY WEARY MILES OF DETOUR

Wind and water, exerting their Titanic forces on the bay ice, cause buckling ridges, which sometimes assume the proportions of young mountains. Such obstacles often reared themselves across the trail and entailed arduous detours.

were frozen and thus held their shape. Man pemmican is made of ground beef, squeezed dry and then mixed with fat. Dog pemmican has meal mixed with it.

The sledges were beautiful examples of Norse craftsmanship. Three of them were single-ended Norwegian army sledges, lightened by cutting away the superfluous wood and relashed with rawhide. One of these was sent to me by Amundsen, who had used it in the Antarctic. Three other fine ones were made by Balchen and Strom, who cut them out of ash and hickory.

Gould and his men had hard going. To make time they arose at 6 o'clock in the morning and traveled until 9 at night. Most of the time, as Gould radioed, "We have been too tired after a long day's trek to turn hand generator of radio to tell you much about it."

The men had to travel on skis practically all the way. The skis were life-savers; without them the men could not have crossed the countless crevasses, holes and haycocks. Skis distribute the weight and slide over the thin roof of a crevasse where a man in boots would fall through. Many a Polar traveler has been lost for the want of a ski or a snowshoe.

Heavy, blinding snow and a 10-mile wind continued during the last week of the struggle toward the foot of Queen Maud Range.

PLANES ARE TUNED FOR POLAR FLIGHT

The geological party had no sooner left camp than we began tuning our planes for our flight to the South Pole. We had been getting them in condition for many weeks.

Our Ford plane, the *Floyd Bennett,* was hauled out of its hole in the snow, its center engine roaring, men heaving on the rope fastened to the skis, the thick wing lifting slowly over the snow until it stood perched on the top like some prehistoric bird of this lost continent.

It was desperately cold for such work—50 below, some days. At times the men could not work with gloves. They covered their hands with grease, yet they burned and blistered from handling metal tools.

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NORMAN VAUGHAN MAKES REPAIRS ON A PUGNACIOUS HUSKY

One of the favorite occupations of the sledge dogs was fighting among themselves. Members of the expedition entrusted with their care had frequently to turn surgeon and sew up canine wounds.

Day after day the men worked in temperatures they could not have withstood at home. They checked motors, rigged throttle and spark controls for the engines, changed gas lines, installed a new gas gauge, jacked the plane up, put on new ski pedestals and aligned them, altered cowlings, and made the innumerable adjustments needful for a plane to fly.

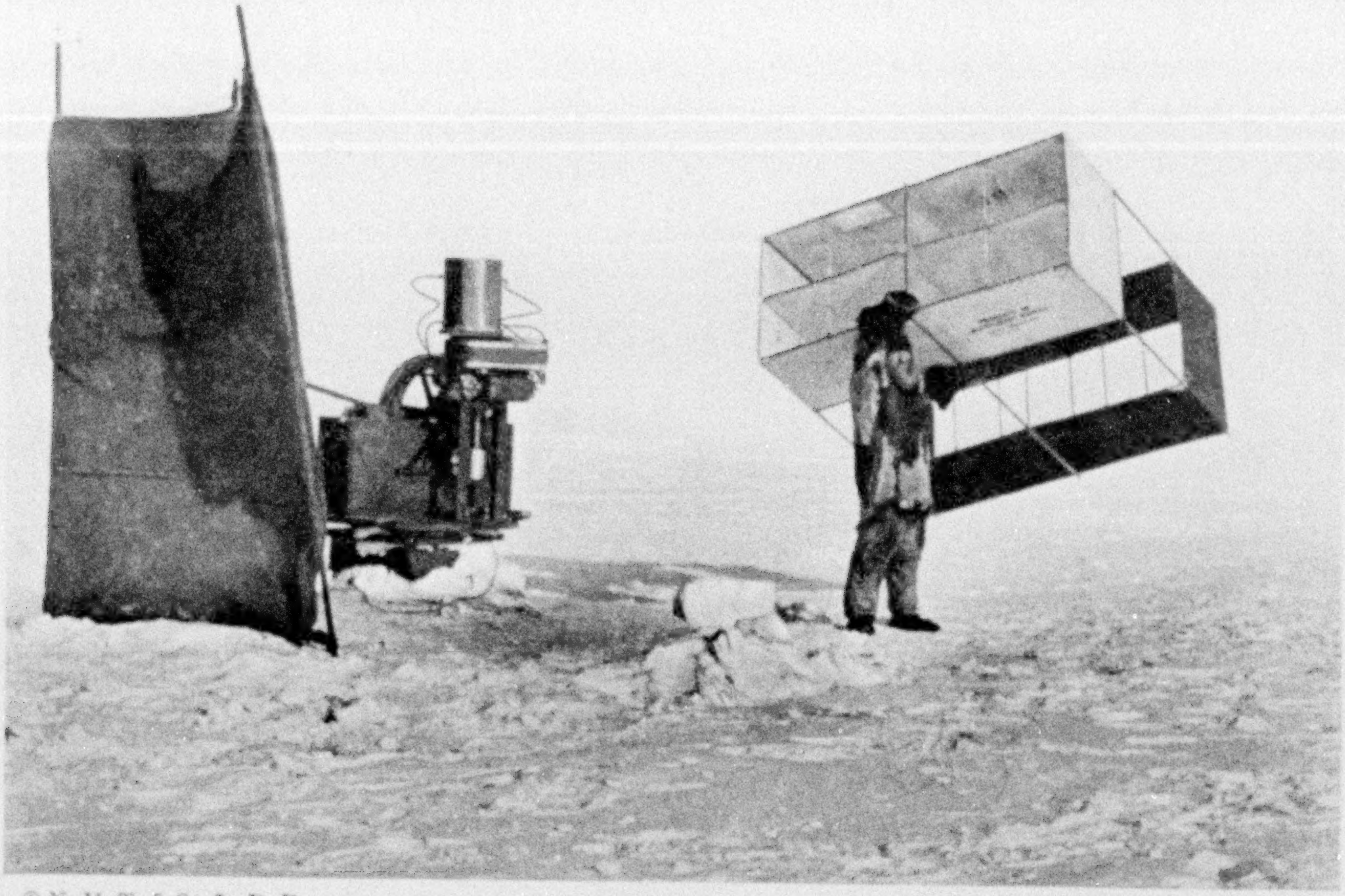
To minimize the discomfort endured by mechanics, we built a large movable windshield on sleds. It was made of canvas stretched over a wooden frame. It was vital to start work early in the spring so that we could have the planes ready to fly when the first good flying weather came.

I cannot emphasize too much the work done by our mechanics—Bubier, Roth and Demas. On a long, spectacular flight the pilot literally rides his engines. He makes it if the engines keep going and he fails if the engines fail. The mechanics made it possible for us to fly to the Pole.

Parker took the plane up for its first test and no greater compliment could have been paid him and the mechanics than the number of passengers who tried to tumble into it.

CLEAR WEATHER ESSENTIAL FOR FLIGHT

Our flight to the Pole was different from most other long flights, in that it was absolutely essential we have clear weather. The flight would not be profitable from an exploration standpoint without good visibility. Under certain types of visibility which frequently occur in the Antarctic, flying is not possible. Bad weather would make it impossible for us to get over the high mountains that encircle the Polar Plateau. Many of these are 15,000 feet high, and we would reach them with a heavy load. One can fly safely over the Atlantic under conditions of storm and fog, but in the Antarctic clear weather is absolutely necessary to insure successful passage of the narrow passes leading up to the Polar Plateau. However, it seemed almost too much to expect we should have continuously clear weather, both on the base-laying flight to the mountains and on the Polar flight.



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LA GORCE STATION, THE WORLD'S MOST SOUTHERLY WEATHER OBSERVATION POST

William (Cyclone) Haines, meteorologist, is holding one of the large kites sent up to obtain data on upper air temperatures, wind velocity, and atmospheric pressure. Some of the observations were made at 30,000 feet. At the left are a windlass and an engine used to pull the kite back to earth (see text, page 184).

On November 19 we set out on the base-laying flight. This was an uncertain and most important project—an absolutely necessary preliminary to the Polar flight. In Polar regions it is always hazardous to land away from one's base. Snow surfaces are difficult to judge from an altitude; and it is surprisingly easy to mistake a rough landing field for a smooth one. Such a mistake on this trip might involve a crack-up, with the disturbing and inevitable consequence that all flying accomplishments of the expedition would cease. It was not possible to fly to the Pole and back on a nonstop flight, and still take along McKinley and his photographic gear. We could have accomplished it nonstop without him. The weight he and his equipment added made that difference.

When we started out on the base-laying flight we shared a feeling of excitement and interest; facing us was one of those adventures that occur seldom in a lifetime.

One question that swiftly presented itself was: Could we navigate an absolutely straight course to Axel Heiberg Glacier, 440 miles off? We knew we could not recognize the mountains from Amundsen's descriptions for the reason that there are many very high mountains in that vicinity and what Amundsen saw from the ground would appear very different from what we should see from the air.

On the way McKinley photographed every inch of the route along the Grosvenor Trail. One hundred and fifty miles out we passed over the perilous crevassed regions through which the supporting party, and later the geological party, had worked their way. We could see the orange flags marking a zigzag path working in and out among deep crevasses and pits. The mapping camera alone can adequately describe that chaotic mass of criss-cross chasms, ice blocks on end, fan-shaped cracks and treacherous ice bridges.

We passed the geological party about 200 miles out, and as we looked down upon them from 2,000 feet, it appeared they were making very slow time. We

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ADMIRAL BYRD AND "IGLOO" SPEND A QUIET HOUR IN THEIR ROOM

The explorer is greatly attached to his pet terrier, and "Iggy" was a privileged character. Above the desk are pictures of the leader's family. His room was illuminated by a gasoline pressure lamp which cast a bright, even light.

could see the men pulling beside the dogs. We learned later that this was one of their hardest days; and it must have been a bit disappointing to them to see us flying overhead at a speed of 100 miles an hour. We dropped them mail and supplies from Little America.

Visibility was excellent. We saw thousands of square miles of barrier that had not been explored.

AN IMMENSE GALLERY OF MOUNTAINS

Soon we sighted mountains on the starboard bow. We judged that we could see as far as the Beardmore Glacier, where Scott and Shackleton had ascended the plateau. Later we definitely made out Beardmore Glacier and Axel Heiberg Glacier—a magnificent range.

As we headed toward the mountains, peak after peak sprang into view until the horizon, from southeast to southwest, was one immense gallery of mountains. Nearer still, we saw huge glaciers debouching ice into the barrier through huge, ragged gashes. They are the outlets for the two-mile-high plateau on which lies the South Pole.

Never have I seen such rugged mountains or such magnificent scenery, but to us they were more like jealous ramparts guarding the solitude of the Pole.

McKinley photographed many new peaks.

We navigated as accurately as possible with our sun-compass and drift indicator because we wanted to be certain we could strike Axel Heiberg Glacier dead ahead.

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CREVASSE AREAS WERE WHITE HELLS TO THE EXPLORERS

Through such regions progress was tedious and each forward step was taken at the risk of plunging through the surface snow into one of the yawning fissures which extend down to icy waters beneath the barrier. Only by traveling roped together was it possible to traverse such an area in comparative safety (see, also, pages 172 and 196).

Presently we did sight a glacier on our course, but many more appeared to the right and left. Colossal mountains lay scattered in every direction, but, recognizing none of them, we had to trust entirely to navigation. If our course was correct, Axel Heiberg Glacier and Mount Nansen lay ahead. In front of what we took to be Mount Nansen rose a lower mountain with beautiful glaciers debouching from it. We decided to try to land at its base.

A BIG MOMENT OF THE EXPEDITION

This was one of the big moments of the expedition. Everything was staked on that experiment. It was one of the risks an explorer must sometimes take to win. We did the best job we could in selecting the smoothest possible landing field. There were many rough places all around us.

I waved to Dean Smith to descend. We dropped four smoke bombs in line to determine wind direction and altitude. We struck the snow, bumped considerably and came safely to rest. We were in a rough area; Dean had made a splendid landing.

We made our little base—the southernmost base in the world—depositing there gasoline, oil, 350 pounds of food, a pressure gasoline stove and other equipment. The food, gasoline and oil could also be used by the geological party for the completion of their mission. We named this base for Josephine Ford, Edsel Ford's little daughter, for whom we had named

Photograph courtesy Paramount Publix Corp.

PRESSURE ICE OFFERED ROUGH GOING ON THE FIRST STAGE OF THE GEOLOGICAL PARTY'S JOURNEY

Leaving Little America on November 4, 1929, the party of six men with ten sledges did not return to headquarters until two and a half months later. The dog near the center of the picture has broken through the snow covering a narrow crevasse (see text, page 191).

Photograph courtesy Paramount Publix Corp.

OFF ON THE LONG, LONG ICE-BOUND TRAIL

The geological party setting off across the Bay of Whales on its 1,300-mile sledge trip. In the background are pressure ridges and faintly visible beyond them rises the barrier wall.

the North Pole plane. We did not stop the engines, which would have involved draining the oil. In that low temperature oil would have solidified at once in the motors.

I took astronomical sights which gave us a line close to the position at which we calculated we had landed.

As we got into the air, heading for Little America, I looked back down upon the base and wondered if we should reach it again. Would we find it clear enough to land there on our way back from the Polar flight?

ALL ENGINES SUDDENLY FAIL

Our troubles were not over. Approximately 100 miles from Little America we reached an area which the dog teams had reported dangerous, if not impossible, for an airplane landing.

Over this place the motors began to miss. June said we were low on gas. Suddenly all three engines stopped. Dean Smith had the wheel; again it was up to him.

We bumped hard, rocked along crazily, and came to rest without smashing, greatly to our surprise. It hardly seemed possible that we had gotten down safely in this area. We were on the edge of the worst part. We were lucky.

Those at Little America knew almost instantly we had had a forced landing because the automatic radio transmitter cut out as soon as the engines stopped. They were naturally apprehensive.

We remained on the ice for 36 hours, working like Trojans, draining oil, putting up radio, etc. Luckily we were on our course and had landed near the Grosvenor Trail, so that when Balchen flew out to us with gasoline he found us easily. We had carried three pressure gasoline stoves with which to heat the engines, and we warmed up the oil on a primus stove. The return to the base was uneventful.

CHIEF SCIENTIFIC OBJECTIVE OF FLIGHT

The prolonged preparation for the Polar flight I can outline all too briefly.

The major purpose of the flight was to explore and make an aërial survey of the lane of vision between our base and the Pole. Visibility to the right and left would be at least a hundred miles and we were certain to see something of geographic importance. We planned a photographic record of every mile of the 1,600 miles over which we were to fly.

We would photograph to the east on the way to the Pole, and to the west returning. Never before had anyone made a single strip map so long in one exploration flight, and McKinley was to attempt the new feat under new conditions. We could not hope to get a very accurate survey. But the mosaic photographic maps would be of much scientific value. There would be available to science practically all we would see. This permanent record was to me the achievement of the flight.

The camera was aimed through apertures on either side of the plane and protected by canvas flaps fastened about it.

Our all-metal, tri-motored Ford monoplane, the *Floyd Bennett*, had already had an amazing history. It had flown under all sorts of conditions as far north as latitude 60, had been transported over salt water through the Tropics, dropped several feet to a dock, landed in sections on a crumbling ice barrier, from which parts were rescued with difficulty, drawn to camp by dog teams, buried in a snow hangar during the world's severest winter—and yet it had emerged in good condition!

Except for special joints and pieces, such as the landing gear, that must take up tremendous strains, the metal used in it was duralumin. The pilot's cabin was glass-enclosed and built for dual side-to-side control.

The plane weighed about 6,000 pounds empty and its gross weight, loaded for the Polar flight, would be about 14,500 pounds. Following tests, we had installed in the nose a 525-horsepower radial air-cooled Wright Cyclone engine. The three original 225-horsepower engines did not provide enough power to get over the mountains with our heavy load.

This 525-horsepower replaced the smaller nose engine. Tests made by Balchen and June indicated the plane would cruise at approximately 105 miles an hour.

FACING A 10,500-FOOT MOUNTAIN WALL

Days of discussion and study went into planning the supplies and equipment we had to take for the contingency of a forced

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AS HE FLEW OVER THE SOUTH POLE ADMIRAL BYRD PAID TRIBUTE TO A DEPARTED COMRADE

In honor and memory of Floyd Bennett, beloved companion of his other great adventures, the Admiral used a stone from Bennett's grave in Arlington to weight an American Flag which he dropped while flying about the South Pole. The picture was taken in the camp library, just before taking off for the Pole.

X

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"SMOKE" FORMS OVER THE ROSS SEA

A water temperature which is much warmer than that of the air causes "sea smoke" to form. While Antarctic air temperatures are always low, there is a tremendous heat in the sun's rays and a tarpaulin spread upon the snow sank nine inches in two days. Snow is frequently in the air but more often blowing than actually falling.

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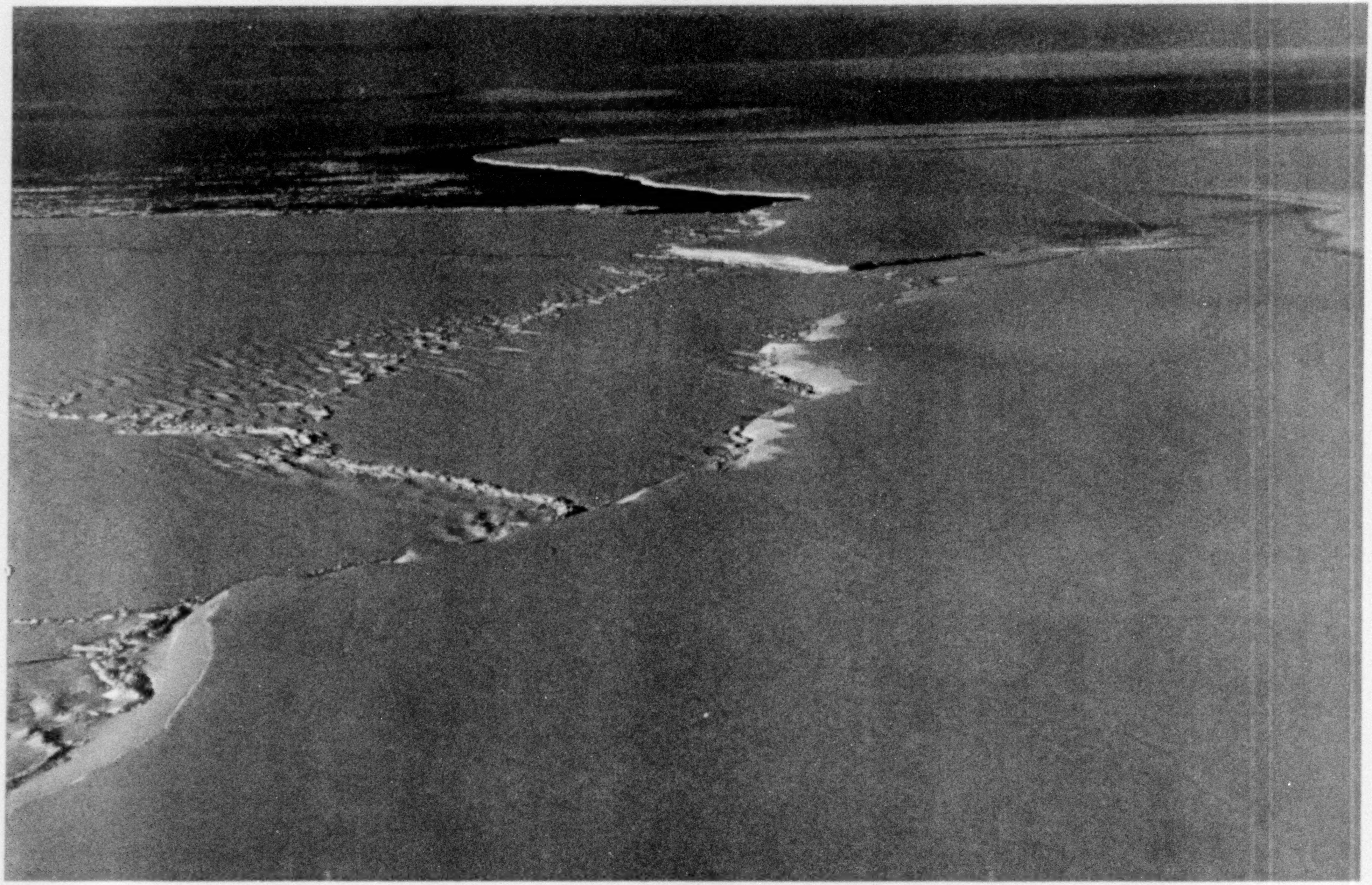
ICE HAYCOCKS, MERELY SURFACE BUMPS FROM WITHOUT, MAY DISCLOSE MARVELOUS BEAUTIES FROM WITHIN

They are probably caused by comparatively warmer water exerting an upward pressure through a crack in the ice. When once the outer crust is broken open, weird, exquisite formations of ice crystals are revealed. Nearly all foot travel had to be done on skis, and many of the command became experts and consequently fast travelers over the endless snow surfaces.



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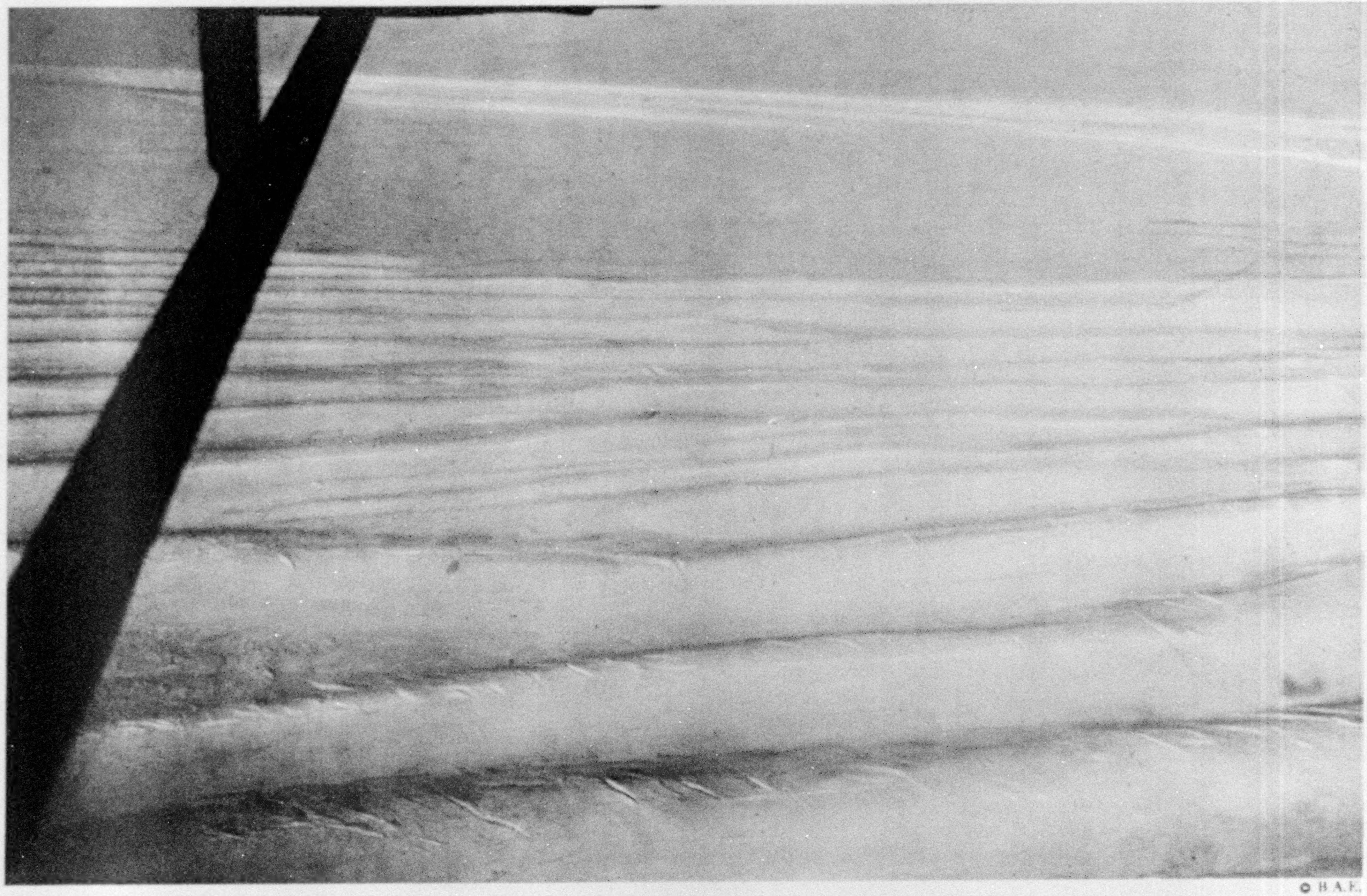
LITTLE AMERICA AND THE BAY OF WHALES SEEN FROM A MILE IN THE AIR

The darker base camp is faintly visible in the right background with a trail leading away five miles to the point at the barrier edge where the "City of New York" was made fast (just left of center background). If it were not for such places as the Bay of Whales where the bay ice forms a platform on which snow can drift and thus form an inclined surface to the top of the 50 to 100 foot barrier, it would be extremely difficult to land.



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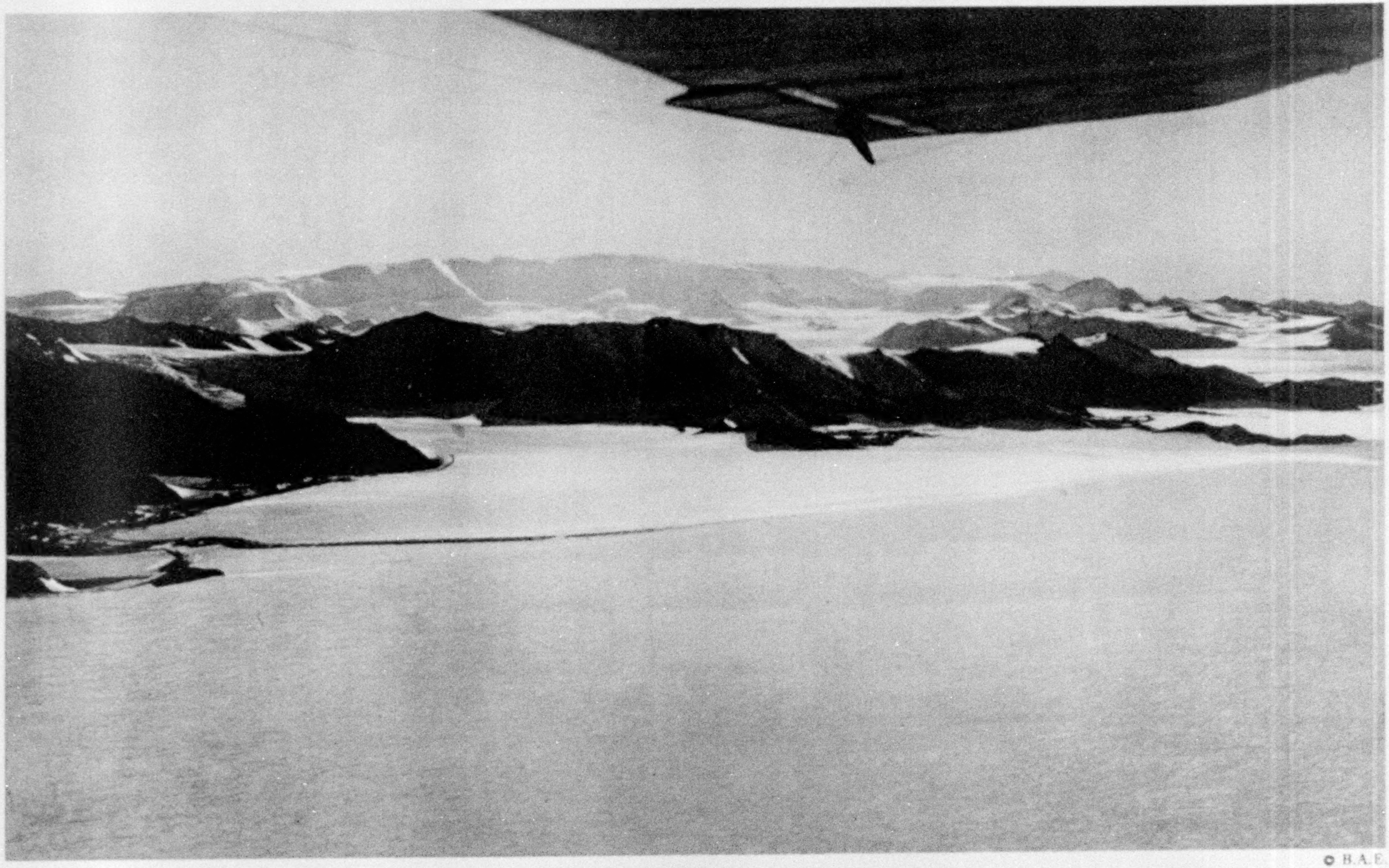
SEEMINGLY A ROLLING SEA OF ICE

The enormous pressure of wind and water sometimes causes the bay ice to form into rolls 40 to 50 feet high. From the sky the effect is of frozen billows but they are full of cracks and make surface travel very difficult and dangerous. The plane's tiny shadow is visible in the lower right corner.



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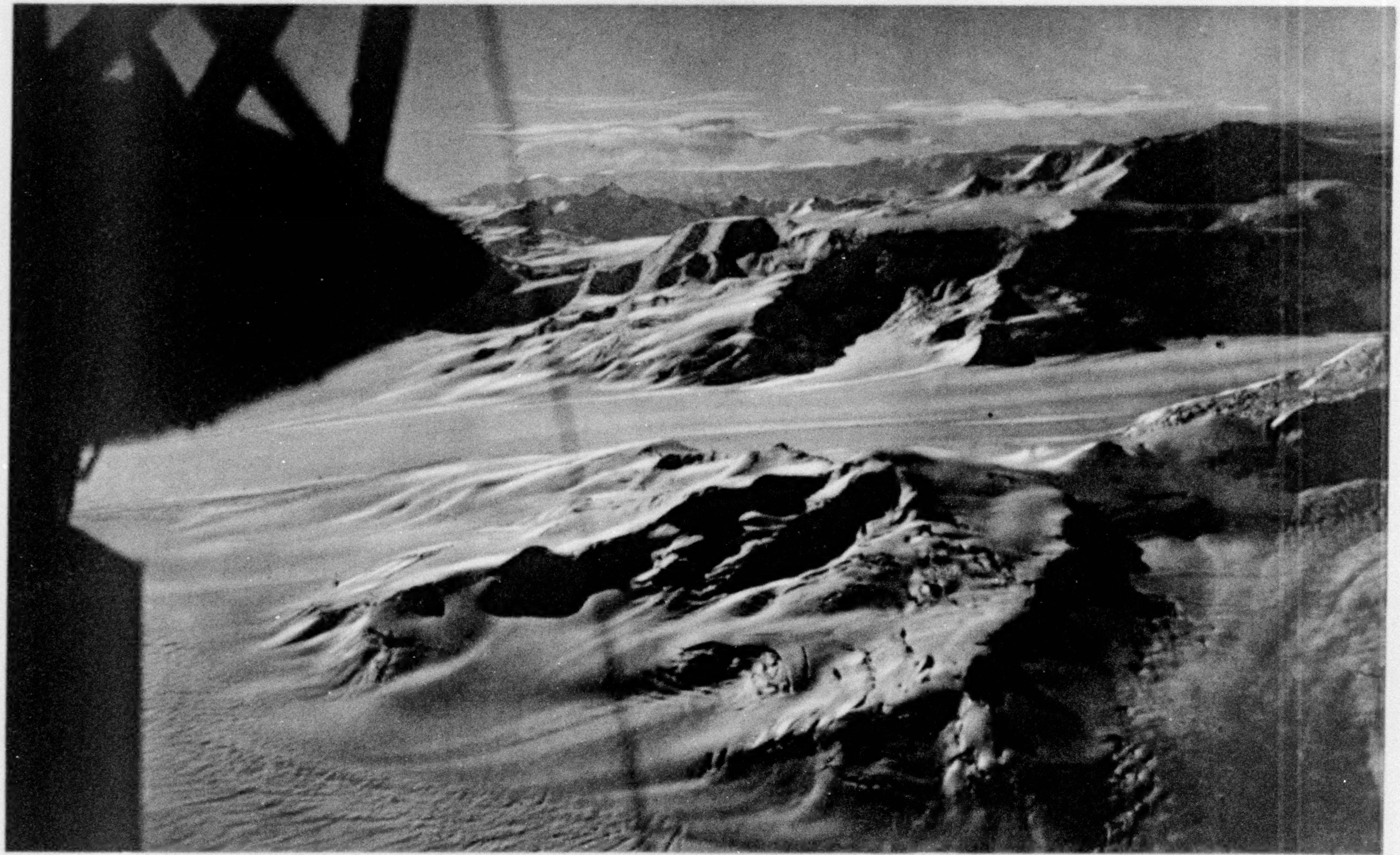
GAUNT SENTINELS OF A LOST WORLD, ANTARCTICA'S GIANT PEAKS REVEAL THEIR AGE-OLD SECRETS TO THE AIRMAN

The Polar flyers looked down on a vast domain never before seen by human eyes. Gallant Amundsen passed this way on his dash to the Pole in 1911, but traveling on foot his range of visibility was very limited. Indeed, while a sled party can see over the flat snow approximately 50 square miles, from an airplane 10,000 feet up the visible world covers an area of about 50,000 square miles.



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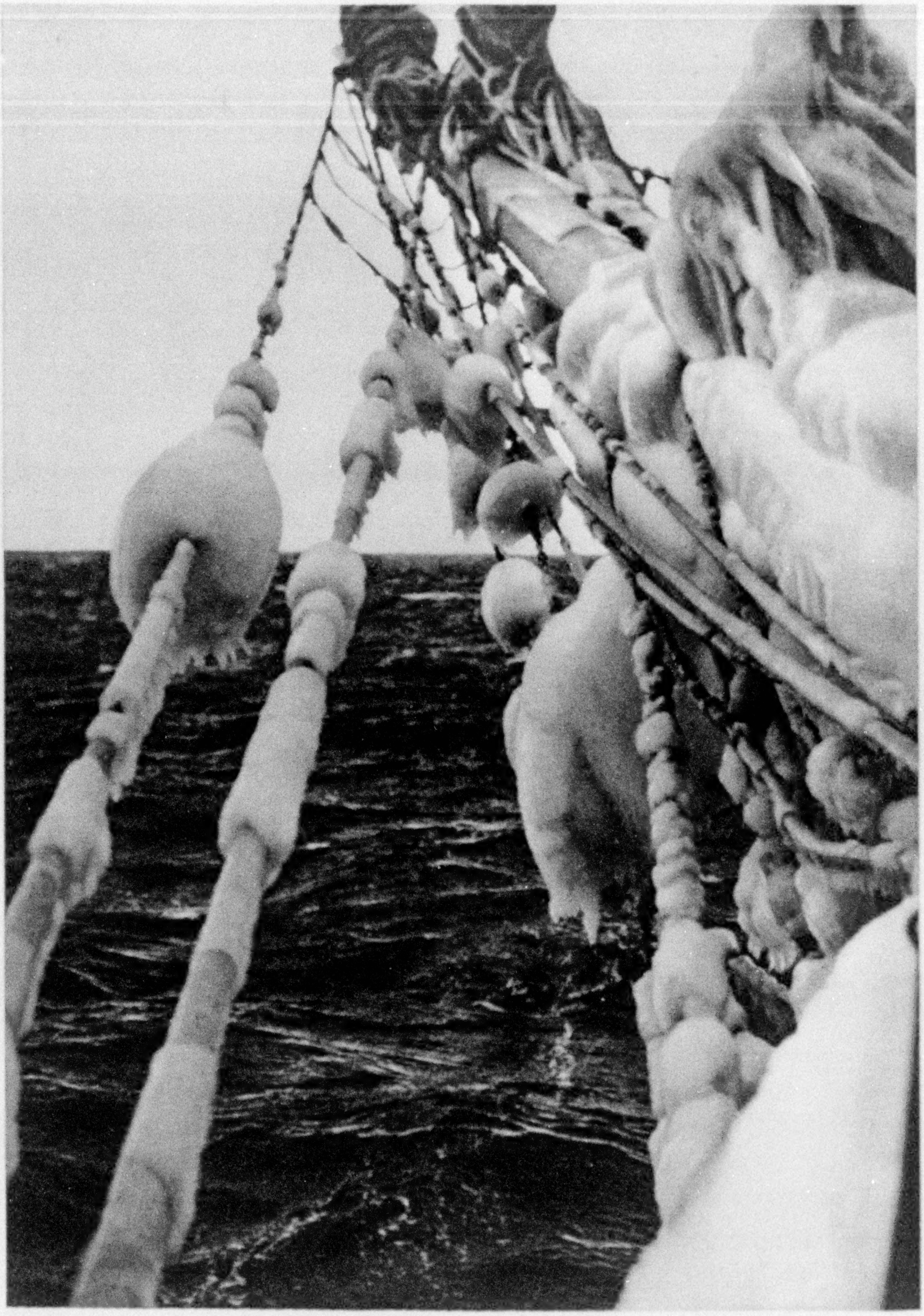
RETURNING FROM THE POLE, THE FLYERS FOLLOWED THE COURSE OF AXEL HEIBERG GLACIER

This was done to avoid the 15,000-foot mountain peaks which rose on every side. On the way to the Pole they followed the Liv Glacier and even then had to throw out 250 pounds of food to lighten the plane and give it the lift necessary to rise above the 10,000-foot Polar Plateau. A stop was made on the return journey for gas, which most wisely had been previously deposited near the base of the Queen Maud Range.



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THE "CITY OF NEW YORK" BARELY WON ITS RACE WITH ONCOMING WINTER

The sturdy little ship ran into a freezing 90-mile gale and at one time was estimated to be encased in nearly 150 tons of ice. This weight presented a serious problem and all hands were put to chopping it free. The Bay of Whales was freezing up when she finally arrived and the party made record time in loading its equipment and bidding farewell to Antarctica.

landing. I had to balance every ounce between the primary consideration of the safety of my men and lightening the load for climbing the mountain wall of 10,500 feet to reach our objective. The chance of getting back in case of a forced landing far away from the base was so slight that we had to make our clothing, food, and camping and sledging equipment as nearly perfect as possible.

George Black, supply officer, was responsible for the equipment. I knew there would be no doubt that everything would be in the plane as we had planned.

At one stage in our preparations it appeared as if we could not take McKinley. But neither Balchen, June nor I could manipulate the 100-pound camera. Aërial surveying is a highly specialized work. We estimated that McKinley, his surveying outfit, his equipment and food weighed 600 pounds; then we pared down the total to make room for him. We were taking a considerable chance of failure, but if we should succeed it was worth the risk to secure photographs of every mile of our route, both to the east and to the west.

We were to fly into an unknown country of changeable weather, sudden blizzards, and extraordinary light conditions which often mark the surface of the snow. "Landing fifty feet up," as aviators say, is a constant danger there.

Also, we were to navigate over areas of unknown magnetic variation, although we would more or less follow lines of longitude. Here, our sun-compass would be of great value.

The Polar Plateau, on which surface altitude rises from near sea level to 10,500 feet within 50 miles, not only presented a major mechanical problem but complicated navigation problems as well.

When flying at sea level the speed of an airplane can be checked in approximate terms if the barometric pressure is known. However, we were to fly over a high plateau ranging in height from about 8,000 to 11,000 feet. We would not know the rapidly changing distances between it and our plane, and our speed meters must therefore fail to give us approximate speed. Still, if we used the speed meter while flying over some crevasse or haycock on the way south, then repeated the operation going north, the speed could be determined. We also had smoke bombs we could drop on the snow to sight on.

We had to wait upon Nature for one essential condition of our flight—sunshine. We did not expect clear weather over the 792 miles of our course from base to Pole in that uneven climate. But we had to have clear skies when we climbed the mountains, or run the risk of colliding with a peak while groping through a sea of milky mist. We knew that during the whole flying season we might get only one or two days of favorable flying weather.

"GO NOW: SECOND CHANCE MAY NOT COME"

On the morning of November 28 the geological party reached a point about 100 miles from the foot of the Queen Maud Range, and flashed weather reports to Haines. One of the reports from Gould said conditions over the plateau were favorable. Haines had a tremendous responsibility. "They could be more nearly perfect," he said, "but you had better go now; another chance may not come."

We took off on the flight to the Pole at 3:29 o'clock (10:29 p. m. New York time) that afternoon. Clouds partly covered the sky at the base. Our concern, however, was the weather at the mountains.

The last thing we put in the plane was a stone that came from Floyd Bennett's grave at Arlington. We weighted it with the American flag, to be dropped at the Pole. This flight he and I had planned together, as we had planned the transatlantic flight. Fate sidetracked him from both. But he was not forgotten.

As the skis left the snow I saw my shipmates in the white bowl beneath us, dancing, jumping, shouting, throwing their hats in the air, wild with joy that we were off for the Pole. I got the same kick then that I got when I looked down upon an exactly similar scene in 1926 as Bennett and I left the snow and headed toward the North Pole. These fellows had given us our great opportunity and they were unselfishly glad.

LIKE FLYING IN A BOWL OF MILK

My planemates were Bernt Balchen, Harold June and Captain Ashley McKinley. Balchen was pilot.

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THE CHIEF GIVES A FEW LAST-MINUTE INSTRUCTIONS

Before the geological party's main expedition set out, a sledge party went forward to establish food depots. Admiral Byrd is talking to Arthur Walden, who led this party, and Joe de Ganahl, the navigator. The wheel between the Admiral's legs is a sledge meter to record mileage over the snow (see text, page 185).

My only regret was that I could not have Parker and Smith with me. They would have been if our plane, the *Virginia,* had not crashed.

We might as well have been flying in a bowl of milk, for all the visibility we had. In the south a rim of blue sky showed.

We circled and in a few minutes emerged from clouds into sunshine that stretched clear to the horizon ahead.

A thousand feet beneath us we picked up, after a few minutes of searching, the dog-team trail. It was a faint, broken thread. Time and again we lost it, then picked it up by keeping on a straight course with the Bumstead sun-compass.

An easterly wind forced us to head ten degrees to the left. Thus we crabbed along southward, constantly checking our course by drift indicator.

At 4:25 we passed over the snowmobile, abandoned wreck of our experiments to use automotive transportation in Antarctica. Others had tried ponies. The dog and sled are still supreme on Polar surface trails.

June radioed to base, "Flying well; motors fine. Now at the crevasses." When we got beyond them we carefully scanned the horizon to the eastward for evidence of land. There was none.

We sighted mountains to the westward. Again I was struck with their majesty. We saw one great mountain mass end and then another one, not on the maps, begin to the south. It lay toward Beardmore Glacier.

Huge white glaciers flowed into the barrier. One hundred miles away snow-covered peaks glittered like fire in the sun's reflection.

PART OF CARMEN LAND WIPED OFF MAP

Visibility was excellent. All of us searched carefully to the eastward and McKinley photographed the horizon. This was important because it meant that we were taking the "appearance of land" off

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A REMINDER OF THE FIRST MAN TO REACH THE SOUTH POLE

Within this cairn, and preserved in a tin can, Dr. Gould's geological party found a page from gallant Amundsen's notebook on which he had written a brief account of his attainment of the South Pole (see, also, text, page 220).

the map. When we reached 85° latitude south we still could see no land east or northeast, nor was there any land or mountains to the eastward between 84° and 85°. This meant that a large part of Carmen Land was now removed forever from the map, and that the limits of the barrier are indefinitely extended to the east. This discovery reopens the question as to whether or not there is a connection between the Ross Sea and the Weddell Sea.

It was natural for Amundsen to be misled about the extent of Carmen Land, owing to the extraordinary conditions of mirage that at times exist in Antarctica.

Soon great mountains loomed up ahead. We sped over the geological party at 8:15 p. m., 325 nautical miles due south of base. We had flown south straight as an arrow.

In a bag, tied to a parachute, we had trail photographs, messages—radios from home and letters from friends at Little America—cigarettes and other items the trail party had requested by radio. We also dropped aërial photographs McKinley had taken of the mountains. We had made a rough panorama of them and on it marked our tiny base and Axel Heiberg Glacier and Mount Nansen. These air views of the mountains would enable Gould to save time in selecting mountains for geological investigation.

We could see the men dashing out for the bag. They had been away from base for weeks. By radio I got their exact latitude and longitude. Here was an exact check on our position.

We began our climb while the mountains were still 100 miles away. Before us lay the great uncertainty.

George Black, our supply officer, had weighed everything aboard the ship. The total was a trifle less than 15,000 pounds. By measuring our consumption of gasoline and oil we could tell at any moment what our weight was. This was one of Harold June's many jobs.

McKinley was "fighting" with his camera all over the plane. I was navigating. June was sending radios, dumping gas from cans to tanks, estimating gas

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HOAR FROST COVERED LARRY GOULD'S THEODOLITE WITH ITS LACY CRYSTALS

The instrument which serves for measuring both horizontal and vertical angles had to be defrosted before it could be used.

from six tanks, and between times taking pictures. Later he took his turn at the controls. McKinley and I could take our turns at piloting only when there was no photographing or navigating to do. This opportunity probably would come on the return from the Pole.

Our activity was in violent contrast to the stillness of the lifeless white spaces below.

We were heading for Axel Heiberg Glacier. Amundsen had reported that the highest point of the pass was only 10,500 feet. He also noted towering peaks on both sides.

To the right loomed another huge glacier. We had sighted it on our base-laying flight and it appeared wide enough for air passage. We were more than a mile high when we passed our little cache of food and gasoline—too high to see it.

A CRITICAL DECISION

The sun on the bare, vertical rocks sent up warm currents which struck the cold air above and formed some fog. Balchen and I conferred.

Should we tackle Axel Heiberg, altitude known, but width and air currents unknown? The bordering peaks might be so high that the currents they created would dash us to the ground, hovering as we were near the absolute ceiling of our plane.

Or should we take the unknown glacier, which looked feasible? Beyond the wider pass there might be mountains to block us.

We had to choose now—and the choice would be irrevocable because we did not have enough gasoline to enable us to fly up a glacier and back again and try another. And we had to choose quickly—we were heading into the mountains at a speed exceeding a mile a minute in spite of our angle of climb.

We chose the unknown glacier.

The peaks and their formations now in view were majestic—colossal shapes carved into amazing jagged and rounded forms by untold centuries of creeping ice.

When we had alighted on our base-laying flight the east-west mountain ridge four miles south of us loomed up from the snow as a large mountain. Now, from

Photograph courtesy Paramount Publix Corp.

TIRED, BEWHISKERED, HAPPY, THE GEOLOGICAL PARTY RETURNS

The men seated are, from left to right, Thorne, Crockett, Gould (the leader), and Vaughan. Standing are Goodale and O'Brien. This party spent 77 days on the trail, covering 1,300 miles (see, also, text, page 220).

the air, the towering peaks behind it made our base mountain seem a pygmy.

We realized anew how little the foot traveler sees.

McKinley was elated, snapping picture after picture, panting from wielding his huge camera at high altitude. Harold June was cranking his movie camera, dashing over to the radio to report our position and checking gasoline consumption. The air bumps were throwing both men about.

THE PLANE IS TOSSED ABOUT LIKE A CORK

The critical time had come. The moment of a thousand discussions. How about our gasoline consumption? Enough left to reach the Pole? And not too much to prevent us from climbing over the hump? Czegka had installed a dump valve. We could drop 100 gallons of gas at a moment's notice.

Tranquil now, in a critical time, June examined the gauges of the five gas tanks in the great wing. Then he unscrewed the cap of the fuselage tank and measured that with a stick. He cut open several of the sealed five-gallon tins, dumped the gas into the tank, and threw the tins overboard.

Each can weighed only a pound, but every pound counted now.

He figured on a pad and handed me the result. Then he looked at the engines.

Balchen was fighting to get altitude. The glacier loomed a long way ahead; the lowest point in the pass was still above the nose of the plane. At times the mixed air currents jostled and tossed the plane about like a cork in a washtub.

Wind sweeping up from a 9,000-foot peak to the right helped us, we thought. To the right opened up deep gorges, which meant more turbulent air. Bernt eased off to the left. Ahead lay a long, fairly smooth slope. The air was not so rough, but down currents resisted our struggle for altitude.

Suddenly the ailerons failed to have any effect; the wheel turned loosely in Bernt's hands.

Above the roar of engines Bernt yelled, "It's drop 200, or go back!"

June jumped to the dump valve of our fuselage tank. A slight pressure and 600 pounds of gasoline would go overboard. But if we did that we would not have enough gasoline to reach the Pole and get back to base. That was the story Harold's slip of paper told me.

"THROW AWAY 150 POUNDS OF FOOD!"

The alternative was to drop food. Would that be fair to these men? It is doubtful whether we could have gotten off the plateau if we were forced to land. Food we would need most of all.

"A bag of food overboard!" I yelled to McKinley.

Over went a 150-pound brown bag.

I might have been wrong in that decision. The effect was instantaneous. A plane hovering near its ceiling is as buoyant as a balloon. Bernt smiled. The influence on the controls was marked.

But we were not yet high enough. Mac was still taking pictures. If I had told him to throw overboard his beloved camera, I felt that he would have preferred to go with it.

Slowly we went higher. Again the wheel turned loosely in Balchen's hands.

"Quick! Dump more!" he shouted.

I pointed to another bag. Mac nonchalantly shoved it through the trapdoor. He watched it hit the glacier. More than a month and a half's supply of food for four men lies out there on the ice.

Again the plane responded. No more food should go. I had 500 pounds left. Loss of gasoline meant missing our goal. Would we have to dump more weight? It seemed so.

Those were the slowest minutes we ever spent. Amundsen had described the grandeur of the eastern end of Mount Nansen, which we could see to our left. To our right were even more majestic mountains no one had ever seen.

OVER—WITH A FEW YARDS TO SPARE

Finally we reached the pass. We ambled over—a few hundred yards to spare.

Bernt let out a yelp of joy. No mountains ahead. A clear route to the Pole, dead ahead over the horizon!

Our next thought was our engines. The plateau was so high that the stopping of one engine meant landing in the snow. We had to "ride the engines"—all three of them—to the Pole.

The starboard engine sputtered. June rushed to the gas tank valves. Even McKinley hesitated in his mapping. Balchen manipulated the wheel. The gasoline had been made too lean in our effort to conserve it. The motor sang again.

We had time to look around. The Polar Plateau, at last! Ahead was limitless, level, white. To the left mountain masses towered above the floor of the plateau 10,000 feet above sea level. Some of these peaks must reach 17,000 feet. McKinley's photographs tell the story of those mountains.

I looked to the right and got one of those kicks that attract a man to places like Antarctica and make his going worth while.

A mountain range emerged from the horizon far to the right—a new feature to put on the map of the world. The crests of the peaks did not seem to be high, although they must have been to stand out so prominently above the plateau. They extended to the southward as far as we could see. Mountains, I thought, as I looked around, must surround the entire plateau. They constitute the mighty dam that will encase this vast bowl of ice until future geological ages mark the passing of Antarctica's ice era. Then the ice will melt, and run through the outlets, leaving behind, perhaps, the world's largest inland sea. This is speculation—as yet we can only guess at what is beneath that mammoth ice cap and how deep is the ice. The Polar Plateau is still one of the mysteries of the world we live in.

LOFTY MOUNTAINS LIKE FRAGILE OUTPOSTS

The plateau surface we traversed ranged from about 7,000 to about 11,000 feet. We saw several small scattered new mountain peaks projecting through the snow. It was hard to believe they were the tops of mountains about 9,000 feet above sea level. Rather they seemed fragile outposts of the unmarked goal toward which we were heading.

Our drift indicator showed a wind from the east. We headed the plane 12 degrees left to keep on our course. We now had to watch the drift with the greatest care.

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DR. GOULD AND HIS ASSOCIATES ACHIEVED SPLENDID RESULTS

The geological party, under the direction of Laurence M. Gould, accomplished highly important work while in Antarctica (see text, page 220). Numerous rock specimens were obtained from the hitherto-unexplored Rockefeller Mountains; some of these the leader is examining after his return to Little America.

With the drift indicator and sun-compass we could steer a very accurate course. We were using two drift indicators and Mac and I checked each other constantly.

By means of the method previously described we calculated the speed over the snow. For this operation we had to open a two-foot trapdoor. It was ten degrees below zero, and grew colder as we approached the Pole. The strong wind coming up through the door quickly numbed the face of the observer, but we knew how to handle that.

The wind held us back somewhat. We were making only about 90 miles an hour. It would take us longer to reach the Pole than we calculated. However, these contrary winds we knew would give us a boost on the return flight.

The character of the plateau changed constantly. To the left a magnificent glacier running down the mountains came into view; chaotic masses of crevassed ice shone blue against the white snow.

We passed clusters of haycocks—small, rounded domes of snow that conceal deep pits. We saw sastrugi—hard, wind-formed snow ridges, with knifelike edges—with a brighter glitter than that of snow surfaces. These showed the area to be one of at least occasional violent winds. The mountains Amundsen had reported were fading out of view to the southeast, just as he had seen them disappear as he approached the Pole. McKinley made many overlapping photographs of them.

We attempted to shoot the sun with the sextant, but the plane was not steady enough. We knew our speed and followed a meridian toward the Pole. In the tail of the plane a meteorograph recorded each change in temperature, pressure, and humidity. We would have a permanent record of the altitude of the plane at any given time.

AT THE LONELY BOTTOM OF THE EARTH

About a half hour past midnight we tried again with the sextant. This sight was better and showed us to be very near our dead-reckoning position, approximately 50 miles from the Pole, which was

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Aërial photograph by Capt. Ashley C. McKinley

FOLLOWING LIV GLACIER, THE FLYERS AVOIDED RUGGED PEAKS WHICH ALMOST SURROUND THE POLAR PLATEAU

Although it offered an avenue of approach to the aviators, this glacier presented serious difficulties to the geological sledge party, which traversed a part of it. Its surface is badly crevassed and snow-blown.

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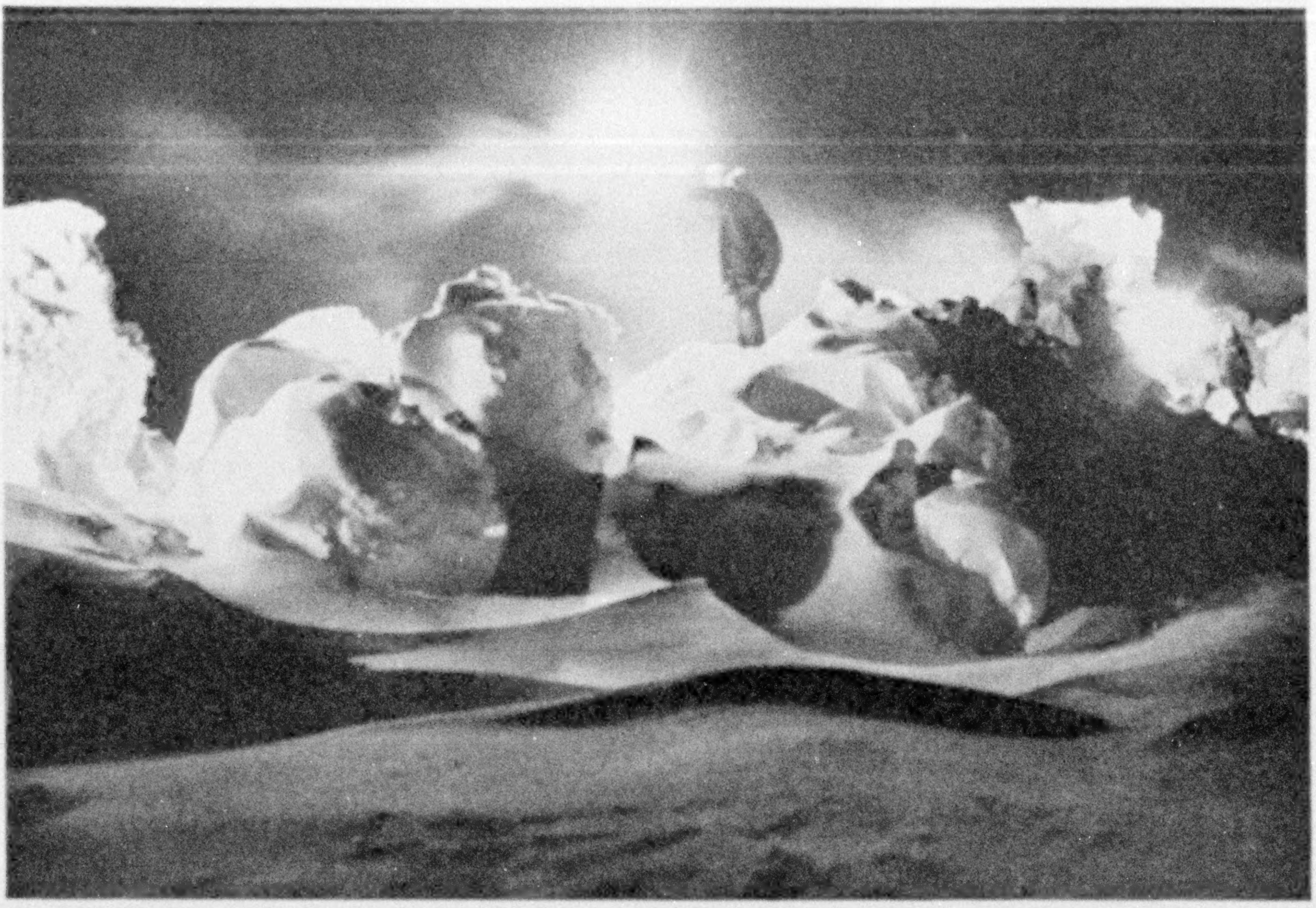
THE GEOLOGICAL PARTY CAMPED AT THE FOOT OF THE QUEEN MAUD MOUNTAINS, ONLY 350 MILES FROM THE POLE

While out on an exploring trip from this base, Larry Gould and Mike Thorne, on Christmas Day, 1929, found the cairn which Amundsen had left 18 years previously, near the foot of Mount Betty (see illustration, page 209).



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PRESSURE ICE ASSUMES WEIRD AND GROTESQUE PROPORTIONS

After the long winter night settled down in mid-April, all exploring had to be done by artificial light. Under its rays the areas of pressure ice looked like glimpses of some chaotic lost world.

good. Another sight later on gave us a line of position that went through the Pole. This sight put us at the Pole well ahead of the time that our other sight and calculations had indicated.

June was piloting and Balchen came aft to report the air was not very clear ahead. Clouds were approaching. We thought we could beat them back to the mountains. Did they bring strong winds with them? It now appeared certain we should have to race the clouds back to our pass through the mountains. If we lost, our retreat would most likely be cut off and we might have to face the uncertainty of a landing 10,000 feet above sea level, perhaps on rough snow.

Our time showed us that the barrier side of the mountains was four hours back; and from there it is 300 nautical miles from the Pole! No wonder my companions thought I was flying beyond the Pole. The wind had slowed us up.

But the big moment had come!

That imaginary point—the aloof and lonely bottom of the earth—was beneath us. I handed June a message to radio to Little America!

"My calculations indicate we have reached the vicinity of the South Pole. Flying high for survey. Soon turn north."

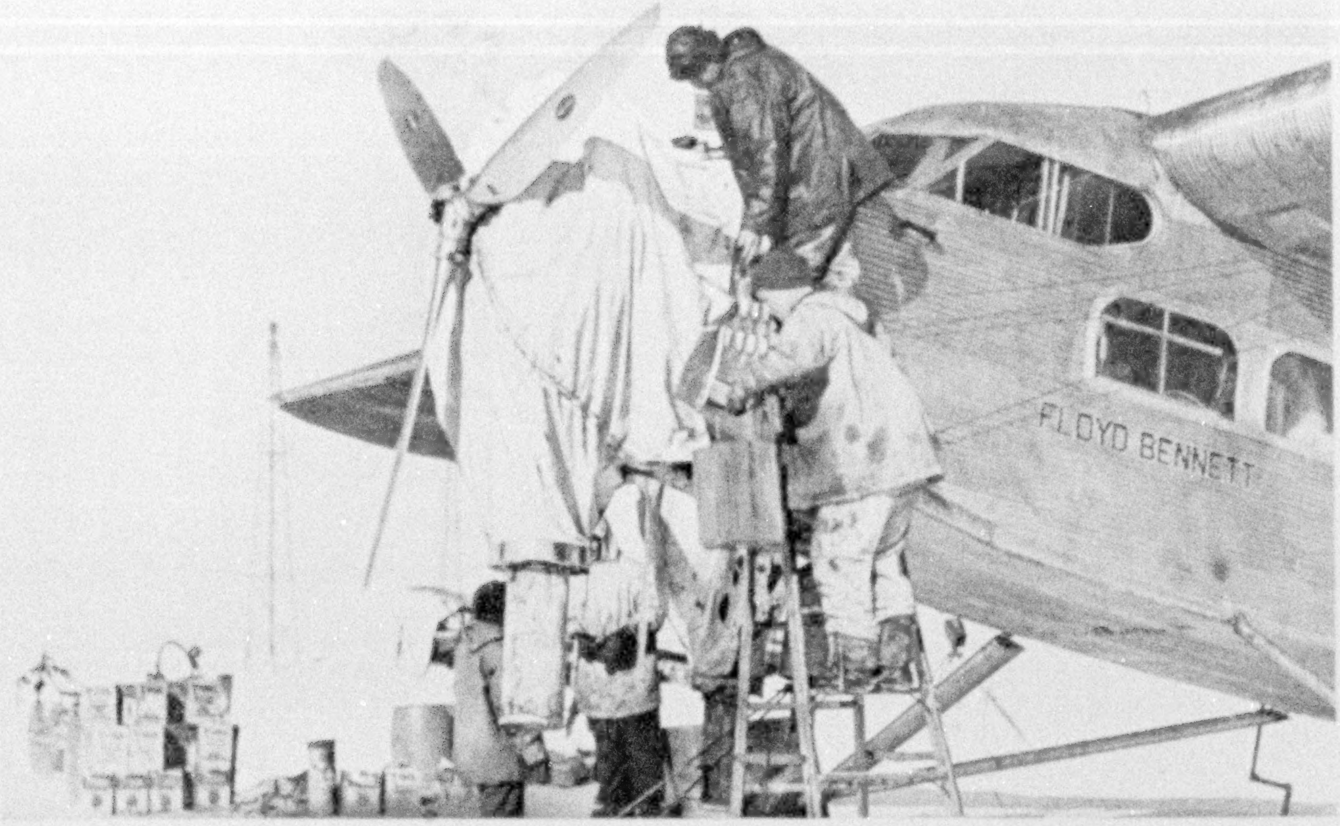
Perhaps the last sentence was superfluous. We could fly in no direction other than north.

We opened the trapdoor and dropped the American flag, weighted with the stone from Bennett's grave. We saluted our country's flag and the spirit of our gallant comrade (see gravure plate IX).

We turned right, and flew three or four miles, then circled and flew left for an equal distance, then back to our original line of flight on a diagonal course. After we had gone about six miles beyond the point where we turned right, we turned back.

FROM "TO-MORROW" TO "YESTERDAY"

We flew over the Pole at an altitude of about 2,500 feet above the snow. This was about 11,500 feet above sea level. The temperature had dropped meanwhile



Photograph courtesy Paramount Publix Corp.

WARMING UP FOR THE POLAR FLIGHT

The motor was inclosed in a heavy, fireproof canvas bag, under which a gas torch was lighted. The oil was heated on a stove before being put in the motor. Bernt Balchen, Polar pilot, is standing at the top of the ladder.

to 15 below zero. Visibility was good, but not perfect. Clouds obscured the horizon in several places.

In the vicinity of the Poles one must adopt a new conception of time and direction. To try to think in terms of north and south, noon or midnight, or even to-day or to-morrow, is to become hopelessly involved in meaningless, contradictory phrases. At that theoretical point from which all directions are north, the meridians converge. These meridians encircle the earth from north to south and it is upon the relation between them and the sun that we are dependent for the system of time. In all parts of the world noon is the moment the sun crosses the meridian upon which we are located.

At the South Pole we are at all meridians; therefore we can consider correctly that it is any or all times of day at any given instant. If we fly in an arc of a small circle around the Pole, we can go from to-day into to-morrow in a very few minutes, or we can reverse our course and fly back again into yesterday.

Directions are just as meaningless. Near the Pole we can start flying on a straight line to the southeast, and in a few minutes that straight line will have changed its direction ninety degrees to northeast.

We were in an infinitely restricted area where we had to abandon the usual methods of navigation and depend solely upon the bearing of the sun.

A FLAG FOR THE IMMORTAL SCOTT

The immortal Scott lost his life to reach that spot—the South Pole—which lay beneath us. His superhuman struggle showed that things of the mind and heart, the intangible spirit of a man, can have a far more enduring effect than the material results of his struggles. In honor of this hero we carried the British flag beside the American.

We turned back at 1:25. A job lay ahead of us. Later, we saw patches of drifting snow beneath us. Like hawks, we watched the sun-compass and drift indicator; for we must hit that mountain

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FLYING OVER THE GILBERT GROSVENOR TRAIL

Admiral Byrd named the route followed by the geological party from Little America to the foot of Axel Heiberg Glacier, and over which he subsequently flew to the South Pole, in honor of the President of the National Geographic Society. Here the plane has surmounted the worst of its obstacles and is winging its way over the great Polar Plateau, the last stage of the historic aërial journey from the South Pole. This plateau reaches an elevation of 10,000 feet above sea level and presents a vast, lifeless surface of wind-blown snow.

pass. We must find our base at the foot of the mountains.

Time now seemed to crawl. The mountains which had been clear were now partly shrouded by clouds.

We aimed our course a few degrees right with the intention of descending Axel Heiberg Glacier. We wanted to reach the barrier east of the point where we had flown over it, in order to get a better view of Carmen Land and photographs of it (see sketch map, page 132).

Suddenly Balchen gave voice to one of his happy shouts. To our left was the pass through which we entered the plateau; Axel Heiberg Glacier was slightly to the left of our course. We swung a bit to the left, then to the right, to have a look at a glacier to the eastward. Then we turned left again and soon we were sliding down a pass into Axel Heiberg Glacier, down which we flew.

It was rough going in the pass, but the plane was light. A few minutes later June, who had landed there before, brought the plane down upon the ice-hard sastrugi at our mountain base.

BACK IN 15 HOURS 51 MINUTES

We took aboard 200 gallons of gasoline and left 350 pounds of food for Gould's party. This would enable the party to remain longer at the mountains. In an hour we were off again.

We landed at Little America at 10:10 a.m., Antarctic time, 5:10 p.m., New York time, having covered 160,000 square miles in 15 hours and 51 minutes. Peary, in planting the American flag at the North Pole, was out of touch with civilization for 429 days, and Amundsen, on his journey to the South Pole, for seven months.

We were deaf from the roar of motors, tired from the strain of the flight, but we forgot all that in the tumultuous welcome of our companions.

I tried to catch up with my correspondence and to acknowledge the inpouring messages of congratulation. These included kindly expressions from President Hoover, the resolution passed by the House of Representatives forwarded by Speaker Longworth, radio from Mr. Ochs, Dr. Grosvenor, Dr. John Finley, and many other staunch friends of the expedition.

NEW LAND CLAIMED FOR AMERICA

On December 4 Haines reported that the slow southerly drift of air up to 10,000 feet promised ideal flying conditions. I said nothing about it until next morning.

I had yearned to fly over the great ice sheet at the eastern edge of Ross Sea—ice which explorers have tried to penetrate ever since Sir James Ross found it in 1841—and map the land beyond. Here was a chance to make the flight.

I had been waiting to complete the Polar flight in order to make this one. That area had long fascinated me—had perhaps beckoned more than the South Pole. We had already made five serious efforts to get into the unknown area northeast of King Edward VII Land, and each time were turned back by either ice or stormy, thick weather. If we could make this flight we should make, I felt sure, a considerable contribution to knowledge of the Antarctic.

I took along Captain Parker, Harold June, and Captain McKinley. Parker was with me at Spitsbergen in 1926.

We climbed to 4,500 feet. A good tail wind blew, and presently we cut across Cape Colbeck, and then Biscoe Bay. Visibility was perfect. The Rockefeller Range loomed up clearly to our right.

We came to Scott's Nunatak, outpost of this unknown. Then the whole of the Alexandra Mountains sprang into view. We were rather surprised to find only a dozen or so nunataks, the highest of which appeared to be approximately 1,500 feet. They did not develop into the mighty range we had hoped to find. McKinley got an excellent view of these nunataks.

In the distance to the left, we could peer into the impenetrable ice-filled parts of the Ross Sea. It was easy to understand why Scott's ship and all other vessels that had attempted to penetrate it had been stopped.

Here began one of the most interesting experiences of my life.

To the right was the beautiful mountain we had seen afar off the previous fall.

I turned my eyes to the eastward and there beheld one of the sights that a man will go to the end of the earth to find and risk everything for. A range of mountains of great extent spread northward and southward, disappearing in both directions in the distance. Here, then, was the answer to this unknown area. It was land and lay east of the 150th meridian, in the territory that we had claimed for the United States (see map, page 132).

AN ARCHIPELAGO OF ICE ISLANDS

The delineation of coast line is always important, and as the range of mountains more or less paralleled the coast line, we decided to follow it to the northeast in order to get the mountains and the coast line in the same photograph. To do this we risked flying over water and ice much too thin to land on. From our starboard windows we presently viewed an extraordinary phenomenon—dozens of islands composed entirely of ice. These ice islands were caught in what I should term shelf ice, which is a kind of ice thicker than bay ice, but not as thick as barrier ice. Most of these islands are circular. It is my belief that they are icebergs, some of them of enormous size, which are grounded on the bottom.

On and on we went, but there appeared no end to the mountain range. To the north and west and a great distance away we observed small islands. We could not be certain, however, that land did not connect these peaks with the mainland, for ice covered everything. Beautiful glaciers debouched from the mountains.

After reaching a point about 350 miles from Little America, we decided to draw closer and inspect the mountains. Mac photographed them as we turned south.

We had not determined the northern end of these mountains, and there is no telling at this time how far they extend. I have often wondered whether they perhaps link up with the South American Andes.

We then flew parallel to the mountains in an effort to find the southern terminus, but they seemed to extend indefinitely. By this time our gas began to run low and we headed back for Little America.

We flew close to the peak we had temporarily named Matterhorn, and McKinley photographed it. Near it we found another phenomenon—several small lakes of water imprisoned in a kind of barrier formation. These lakes extend in a line approximately east and west. Why they did not freeze over in the low existing temperatures I cannot say. McKinley obtained some excellent photographs of them. Further study by scientists might give some answer to them (see illustration, page 181).

"FIRST ON AMERICAN SOIL IN ANTARCTIC"

All told, McKinley photographed 150 miles of the new range, in addition to thousands of square miles of new territory. The mountains run approximately north and south near the 143d meridian. These figures and directions are approximate, of course; more accurate computations will be made when the hundreds of photographs taken on the flight are measured.

In December we were able to make our first sounding near our base camp. Victor Czegka, machinist, and Paul Siple, our Boy Scout, bored a hole through ice 18 feet thick at Ver-sur-Mer Inlet, and a sounding of 1,600 feet was obtained. Our base was floating, as we suspected.

In this work, as in all assigned him, Siple did his part thoroughly. He was a credit to the Boy Scout organization.

A few days before Christmas, Marie Byrd Land was invaded again, this time by the geological party. They traveled 110 miles east of Axel Heiberg Glacier and penetrated well beyond the 155th meridian. Gould radioed:

"Camped at 85° 27′ south latitude and 147° 30′ west longitude, and have completely proved that Carmen Land as given by Amundsen does not exist. This is no reflection upon Amundsen's observation, because his view from the ground must necessarily have been uncertain on account of bad visibility, mirages and enormous pressure ridges that are deceptive.

"We are in Marie Byrd Land and are the first men to set foot on American soil in the Antarctic.

"To-morrow we shall raise our tiny American flag with appropriate ceremony, and hope you will accept this addition to Marie Byrd Land."

AMUNDSEN'S 18-YEAR-OLD CACHE FOUND

On December 25, Dr. Gould found Captain Amundsen's cache on Mount Betty, at the foot of Axel Heiberg Glacier—the cache left there 18 years ago on Amundsen's return journey (see page 209).

I was deeply impressed. It was as if the spirit of the man who had been with us in person when we took off for our North Pole flight had provided tangible evidence of his heroic adventures at that other end of the world. We had carried the Norwegian flag on our Polar flight in honor of him and his comrades.

Back at camp we had a white Christmas, and a merry one, made so by the hundreds of messages transmitted to us all day long from friends, officials, organizations.

Early in the morning of January 19, one of the men let out a yell and everybody in camp turned out to watch a long, black line toiling toward camp. The caravan now etched its serpentine progress against the dead white southern hills of the barrier, then disappeared in a hollow.

It was the geological party coming home from one of the longest sledge journeys ever made for purely scientific purposes. They had covered 1,300 statute miles.

As they topped the last slope at the edge of the camp we recognized the figure of Larry Gould—but it was scarcely the Larry who had gone away two and a half months before. His round, peaked cap stood up like a turban. His black beard, new to us, was bleached white around his mouth. Dark sun glasses hid his eyes. Around his waist was a twisted red and white sash.

NOTABLE WORK BY THE GEOLOGICAL PARTY

As he came toward me his teeth made a line of white in his mask of whiskers, glasses, and grime. No wonder the boys called him Abdul.

I want these men — Gould, Vaughan, Goodale, and Crockett, Thorne and

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THE EXACT SOUTH POLAR AREA

"We flew over the Pole at an altitude of about 2,500 feet above the snow. This was about 11,500 feet above sea level. The temperature had dropped meanwhile to 15 below zero. Visibility was good but not perfect. Clouds obscured the horizon in several places" (see text, page 217).

O'Brien—to have the full recognition they so richly deserve for one of the most arduous, skillful, and productive pieces of work done on our expedition. They had planned their journey, and also executed it.

For weeks they were out there at a point farther from Little America than Boston is from Richmond.

Not one of them had ever before explored with teams. They came back as veterans.

Crockett had learned to be a radio operator. Thorne had become a cobbler. All helped making sleds, sleeping bags, and other special equipment.

Their first camp was at Liv Glacier, at the mountain we had passed on our flight to the Pole. They found the ascent so steep and badly crevassed that they moved over to the lower part of what Amundsen indicated on his chart as the western position of Axel Heiberg Glacier.

Their first field work was to ascend the glacier to reach the rocks that capped Mount Nansen. The flanks of the mountain were encased in ice which in places had pulled away from the rock faces and left huge crevasses.

Gould's diary describes a typical day of this effort:

"December 7—Climbed on skis up saddle between two spurs on southern slope of Mount Nansen—very steep and difficult, with a small ice falls halfway up, a series of crevasses transverse to our course from one to eleven feet wide, and usually roofed over.

"We roped to climb and herring-boned and side-hilled our way up on our skis—an occasional start as a crevasse bridge gave way under us. Had to climb even steeper slope beyond these first crevasses to reach the coveted rocks. It was a bit hazardous, this, for we were climbing along a steep side hill, and some 200 feet below us, paralleling our course, was a great, yawning chasm.

"We became so interested in rock collecting that none of us noted the changing weather. Quite suddenly we were completely engulfed and could see nothing of our surroundings. Then it began to snow.

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ICE ISLANDS OFF THE ANTARCTIC COAST

The photograph was taken from a high altitude and the "postage stamp" islands are in reality a mile or more square (see, also, text, page 219).

"We hurriedly roped and began our descent. We slipped and fell time after time, knowing a big open crevasse was a few feet below us; got up, swallowed our hearts, and skidded again."

A TRIP TO ANTARCTICA TO FIND SANDSTONE

The men climbed, in all, 150 miles of Queen Maud Range. They proved there is no Carmen Land north of latitude 85°, but that the range extends eastward beyond the 140th meridian.

Gould made many glaciological studies. They demonstrate that the great mountain ranges which rise on the western side of Ross Sea continue as a major surface feature, fairly unbroken, to the 140th meridian.

Capping Mount Nansen, Gould found sandstone with a layer of highly carbonaceous material. The men had to climb 6,000 feet, part of the way over a badly crevassed glacier, to reach these cap rocks on Nansen.

Gould flashed us: "No symphonies I have ever heard, no work of art I have viewed with awe, ever gave me quite the thrill I had when I picked up that rock and found it sandstone. Here was what I had come all the way to Antarctica to find."

The time was now approaching for our return to the United States, but before leaving Antarctica I wished to make another flight—to the west this time—to find the land that must be around Discovery Inlet somewhere, for the inlet had been there since Ross Sea was first entered in 1841.

The weather gave us our chance on January 21. Dean Smith, Petersen, radio engineer, Harold June, Captain McKinley and I took off in the Ford, flew 100 miles to the inlet, then south for 140 miles through the center of the great barrier.

The depression and valley at the head of the inlet, which the men had seen when we touched there a year before, extended south only a short way and ended in a flat

surface. Not until we had flown south from the inlet for about 100 miles did we sight a series of pressure ridges to the west.

We turned west and examined the area carefully. A ridge ran east and west; the pressure rolls were to the south and east of it, at latitude 80 and longitude 73 west. McKinley and June are sure they saw rock protruding above the surface.

If there is land at that point, it is one of four known points where land apparently is holding back the barrier, the others being at the Bay of Whales, the crevasses south of the Bay at 81.10 south, and Discovery Inlet.

This flight, with Gould's journey, helped to solve at least one of the mysteries of the barrier. We now can trace the direction of its greatest movement, which is from what Amundsen called Carmen Land to McMurdo Sound, a distance of approximately 600 miles. When this flight ended, McKinley had photographed in all more than 600 miles of barrier coast line, the geography of which had been a most uncertain quantity.

CORRESPONDENCE IN THE AIR BY RADIO

During the flight, while we were examining these ridges, a message from London was relayed to me from our base station. I dictated a reply which was received at Little America, flashed to the *New York Times* station, and there forwarded by Captain Hilton H. Railey to London.

That, too, was a novel experience—exploring new territory, navigating an airplane, and attending to correspondence by radio while flying above those white wastes.

I also had a message from the *Bolling*, which had sailed the day before from Dunedin, New Zealand, heading for the ice pack. The *New York* was approaching the ice pack, and the *Bolling* was to meet her, and to lend steam power to help her through the unusually compact floes that fringed the waters of the Ross Sea.

Presently an exciting—and potentially critical—situation developed. Christmas, the powerful whaling factory ships started through the ice; the pack generally begins to break up at this time of the year. But the last two years had been marked by abnormal ice conditions. In 1929 the ice belt, at its most favorable point of entry, was 240 miles deep; and in 1930, at the same period, it was 400 miles deep at the 180th meridian, which is but a degree or two removed from the point at which the whalers generally penetrate the pack.

The whalers soon met difficulties which augured ill for the much less powerful *New York*. Two of them were forced back by the heavy ice (one lost a chaser) and returned to fish on the northern side. Two others were still stuck in the pack on January 22. In the end, two finally pushed into Ross Sea. All of these vessels, however, suffered damage from their battle with the ice. Lacking power to force a lane of her own, the *New York* was compelled to cruise for days outside the pack. Indeed, for a time it was doubtful whether the pack would open up at all this year.

These conditions had been carefully observed from Little America; and the apprehensions which gained headway in the United States were not entirely shared by us. Radio messages informed us that newspapers at home carried dramatic stories describing us hastily loading our ships; others stated frankly that, unless our ships got through, we would be forced to spend another year on the ice, and, because of reduced supplies, faced starvation.

NO DANGER OF STARVATION

These reports were exaggerated. Under no conditions did we face starvation. We had enough food to carry us through a second year. What did disturb us was the poor physical condition of several of the men. One man had appendicitis, and might require an operation any day. The health of others was so precarious that it was doubtful they would outlive a second winter on the ice.

As the ice continued unbroken, the necessity of asking one of the whalers to take the *New York* in tow through the pack seemed apparent. Whales, I knew, were scarce south of the pack, and I anticipated that the two whalers which had finally got through would soon proceed north again. By radio I asked them to take back our sick men and several others.

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A HUGE BERG DRIFTED INTO THE BAY OF WHALES AND LODGED FOR DAYS NEAR THE BARRIER

This vast mountain of ice towered 150 feet out of the water and only its top is visible above the barrier wall. If it could have been chopped into 25-pound blocks and delivered in New York in the summer time, it would have been worth millions of dollars.

Photograph courtesy Paramount Publix Corp.

TEN HOURS SUFFICED TO LOAD THE "CITY OF NEW YORK" WHEN SHE FINALLY REACHED THE ANTARCTIC SHORE TO BRING THE EXPEDITION HOME

After a valiant struggle with fast-freezing pack ice, high seas, and battering gales, the sturdy ship reached the ice dock in Floyd Bennett Bay. Under Captain McKinley's able direction, men and dogs worked without surcease until the 40 tons of equipment to be brought home were stowed aboard. Farewell was waved to Little America February 19, 1930 (see text, page 226).

They replied they had already started north, and that an order from the owners in Norway was necessary before they could proceed to our assistance. To get help from one of the whalers, I discovered, would cost $600,000 (including insurance). By the time I got my answer from Norway, the whalers were north of the pack.

THE STATE DEPARTMENT COÖPERATES

Our situation was then critical indeed.

I did not call for help, but took this step purely as a precaution to guarantee the safety of my men. I acquainted my personal representative in New York, Captain Railey, with the gravity of the situation and asked him to stand by for whatever action the uncertain conditions might render necessary. Railey, there in New York, was always an anchor to windward for the expedition.

I am deeply grateful to our State Department for their communications to London and Oslo, which paved the way for whalers to come to our aid if needed. It was unthinkable that I risk the unprotected *Bolling* in the pack ice, though her captain and all the crew wanted to try it. Their spirit was always to go through, regardless of risk.

On January 28 I had a report from Bendik Johansen, ice pilot for our two ships, telling us the ice pack was heavy and dangerous. He advised that not even the *New York* should try to penetrate it until it had opened up more.

That meant that both ships could not lie waiting for ten days or two weeks and have enough coal for a round trip of 4,700 miles through those seas. So I ordered the *Bolling* to leave coal aboard a whaler as a reserve for the *New York*, and then return to New Zealand. That was hard on Brown and his crew.

Meanwhile the staunch *New York* cruised back and forth along the edge of the ice pack, searching for a lead to the south.

Not until February 7 did we get the welcome news that she was through the pack. For three days she bucked the ice. Then she had to lay to in the lee of the pack to escape a heavy gale. She steamed on when the storm abated, only to encounter another terrific storm. The ship was constantly awash. The weather had turned so cold that ice accumulated faster than the men could chop it away. Finally the ship began to go down by the nose. The men worked with superhuman effort, but still the ice gained on them. For hours the storm continued. Toward the end 150 tons of ice were massed on the ship.

Just about the time Captain Melville thought he would have to turn about and run with the wind, he sighted Mount Erebus. He had drifted several hundred miles to the westward—now he was able to get in the lee of the barrier.

SUCCESS AFTER A 44-DAY BATTLE WITH ICE

On the evening of February 18 (our time) we sighted her, sheathed in frozen spray from stem to stern, like a phantom ship against the dim horizon line of frost smoke.

It had taken her 44 days to reach us over a straightaway distance of 2,300 miles—44 days of battling with ice pack, storms and high seas. We all paid tribute to the seamanship of Captain Melville, who brought his ship safely through one of the worst passages an Antarctic ship has ever had, and to the great skill of Bendik Johansen, mate and ice pilot, who piloted it through the ice.

I must not forget here the fine work done by the New Zealand volunteers on the *City of New York* and the *Eleanor Bolling*, who worked shoulder to shoulder with my men.

Our departure from Little America was not without its drama. Captain McKinley had charge of loading operations. For weeks he had been transporting material by dog teams to Floyd Bennett Bay, to have it ready for quick loading when the *New York* reached the ice dock. Tons of our most precious material were stowed in the bay. We had to take the chance that it might float to sea on an ice floe. Several days before the ship came in, the ice drifted out up to the mouth of Floyd Bennett Bay, making an ideal dock. When the *New York* arrived it turned cold, and the ice began to freeze in small floes about the ship.

Men and dogs worked feverishly all through the night. At 9:30 o'clock the following morning, February 19—just in time—we left Little America.

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THE CHIEF AND HIS AIDES EXAMINE PICTURES TAKEN ON THE POLAR FLIGHT

Admiral Byrd (center) is conferring with Captain McKinley, at his right, and Dr. Gould on the results of the aërial mapping, which was the Captain's particular business on the flight to the Pole. The aërial photographer mapped approximately 150,000 square miles of new territory and thereby made one of the most important contributions to the success of the expedition.

A few hours after the *City of New York* arrived at the Bay of Whales our radio station at Little America signed off for quits. It had handled some 15,000 messages in fourteen months.

Returning, we negotiated the ice in a little more than 24 hours. The pack had opened up considerably. Once we got completely stuck. It was cold and the loose ice had begun to freeze into a solid field of ice. A strong southerly wind came along and blew us out of this predicament and into clear water.

On February 27 we were able to transfer our appendicitis case and other men on the sick list to the whaler *Kosmos*.

A GLORIOUS WELCOME IN NEW ZEALAND

With nothing but open water between us and home, I was able to wire the family of every man who had braved 14 months of Antarctic exploration that he had come through safe and sound. It was a great relief to me.

A glorious welcome was accorded us on March 10, at Dunedin, which had bade us good-bye on December 2, 1928. We went to New Zealand feeling as cousins and, due to the extraordinary hospitality of the people and Government, we left feeling as if we were leaving our own people. I was delighted when the Prime Minister asked me to convey to the people of the United States, as unofficial ambassador, the good wishes and greetings of the people of New Zealand.

And now we are at work compiling the voluminous scientific data of the expedition, which will probably comprise three or four volumes.

Our expedition had carried the American flag a thousand miles farther south than it had ever been before. We are all proud of that.

Above all else—what means more to me than anything else—is that we left not a single man in Antarctica, and for that we give thanks to Providence.

ADMIRAL BYRD RECEIVES NEW HONOR FROM THE SOCIETY

SURROUNDED by the heroes of "Little America" and the gallant crews of his ice-battered ships, and wearing the new insignia of a rear admiral in the United States Navy, bestowed by the congressional representatives of a grateful people, Richard E. Byrd, on the evening of June 20, 1930, in Washington, D. C., received from the hands of President Herbert Hoover the National Geographic Society's Special Gold Medal of Honor.

Turning toward the President, Admiral Byrd said:

"I have, for myself, this closing thought, . . . that our expedition accomplished its objectives and carried the American flag one thousand miles farther south than it had been before, which is a cause of pride to me.

"Such a thing satisfies the mind.

"But of deeper meaning is the fact that every man who started out with me returned; that we left not a single man on the ice; that everyone is here to-night.

"Such a thing satisfies the heart."

ONE OF MOST DRAMATIC EXPLORATIONS OF MODERN TIMES

Thus the youthful explorer concluded his modest recital to National Geographic Society members of the scientific accomplishments and adventures of what Dr. Gilbert Grosvenor, President of The Society, had just characterized as "one of the most comprehensive, dramatic, and productive explorations of modern times."

Throughout his address Admiral Byrd was interrupted by applause when, in a terse sentence or two, he would refer to some discovery or achievement of the expedition, the first complete narrative of which he has written for this issue of the NATIONAL GEOGRAPHIC MAGAZINE (see pages 127 to 227) and the scientific results of which ultimately will require four volumes.

This applause was most prolonged when, after describing the discovery of Marie Byrd Land, a vast uncharted area hitherto unseen by the eye of man, he added, simply, "It was first observed on a flight, and claimed in the name of the United States."

On the platform, beside President Hoover, Admiral Byrd, and his command of 79 men, sat the Acting Secretary of the Navy, Ernest Lee Jahncke; Dr. Gilbert Grosvenor, President of the National Geographic Society; Dr. John Oliver La Gorce, Vice President of the National Geographic Society; the Secretary to the President, Mr. George Akerson; Col. Campbell B. Hodges, military aide to the President; Capt. Joel T. Boone, personal physician to the President; Comdr. Harold C. Train, naval aide to the President; Lieut. Comdr. R. H. Skelton, aide to the Acting Secretary of the Navy; Mr. Allan Hoover, Mr. Adolph Zukor, president Paramount Publix Corp.

HIGHEST OFFICIALS IN PUBLIC LIFE ATTEND

The audience was one of the most distinguished ever assembled in the quarter of a century that the National Geographic Society has been the host of returning explorers—such explorers as Peary, Roosevelt, Amundsen, Shackleton, Lindbergh, and Byrd himself, after he had flown to the North Pole and crossed the Atlantic in an airplane.

The Vice President of the United States, the Speaker of the House of Representatives, 31 United States Senators, many members of the House of Representatives, all members of the Cabinet who were in the city, ambassadors and ministers of practically all foreign countries represented in Washington, the highest officers of the Army and Navy, including 35 generals, 36 rear admirals and many junior officers, eminent scientists and civilians were among the guests.

The decorations were arranged by the U. S. Navy as a tribute to Admiral Byrd. On the stage were displayed the Stars and Stripes, the flag of the Byrd Antarctic expedition, and the historic flag of the National Geographic Society, which its expeditions have carried to the Poles, to jungles and caverns and lofty mountain peaks, across lone seas and icy waters, and into remote interiors.

Under the proscenium arch were three Navy signal flags—those signifying "Y-W-X," meaning "Well Done."

Photograph by J. R. Hildebrand

ADMIRAL BYRD SEEKS SHADE IN THE TROPICS TO WRITE HIS REPORT FOR THE SOCIETY

Immediately upon arriving at Panama, Admiral Byrd flew to the tiny mountain village of Boquete, Republic of Panama, to prepare his first complete narrative of his expedition, his geographical discoveries, and his scientific findings for the NATIONAL GEOGRAPHIC MAGAZINE (see pages 127 to 227). Charles Lofgren, his secretary and "right-hand man," is transcribing his notes. Igloo, the explorer's pet terrier, knows enough to keep quiet while his master dictates.

As President Hoover appeared on the platform the audience stood and the United States Marine Band played "Hail to the Chief."

DR. GROSVENOR PRESENTS THE PRESIDENT

In his introductory remarks, Dr. Grosvenor said:

"Mr. President, members and friends of the National Geographic Society:

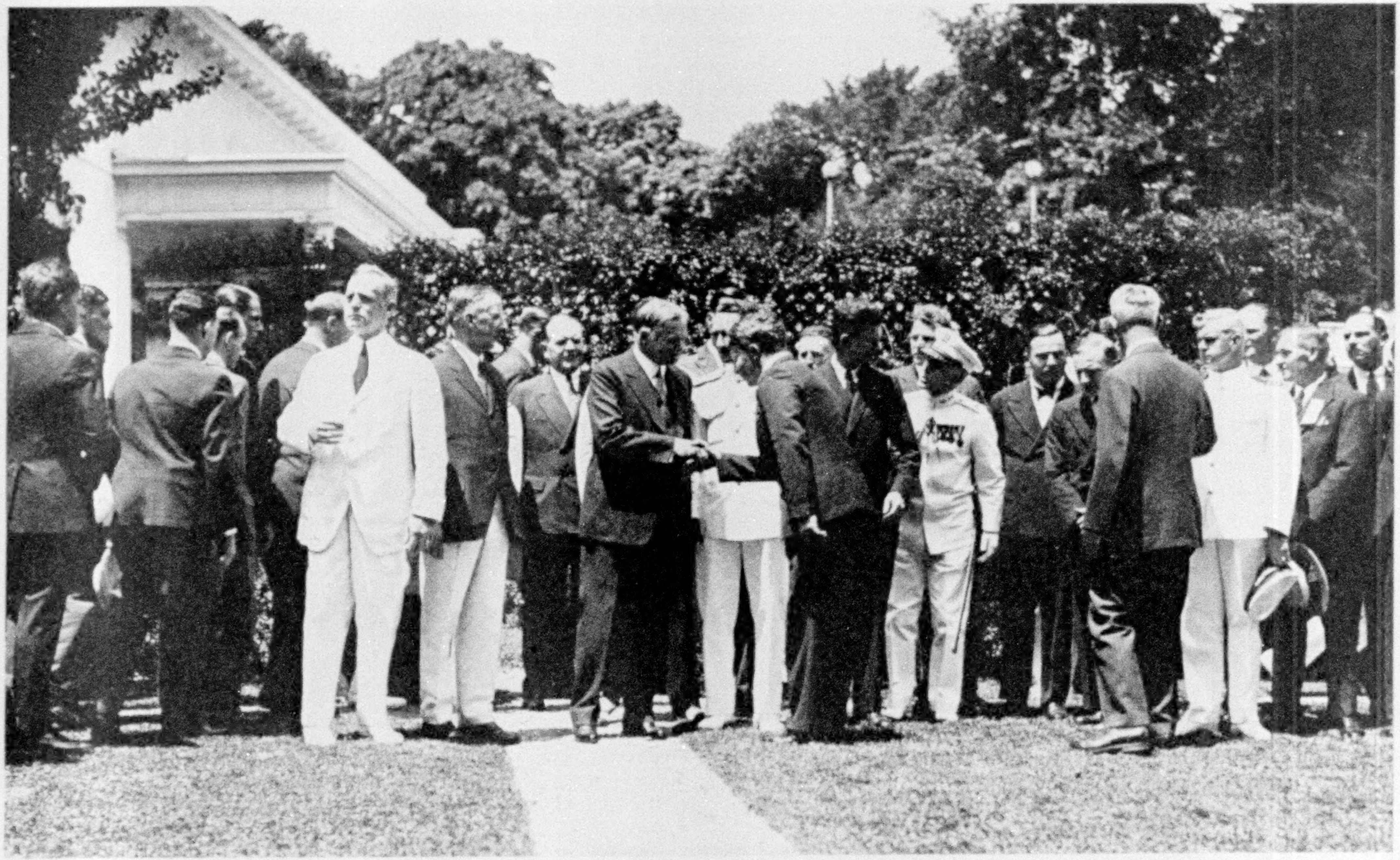
"We are assembled to honor once more a member of our Society who has returned from leading, successfully and brilliantly, one of the most comprehensive, dramatic, and productive explorations of modern times.

"We are proud to recall that his first Arctic flying, in 1925, was under our Society's auspices.

"A year later he first attained the North Pole by airplane—an achievement which won for him The Society's highest award, the Hubbard Medal. Subsequently he flew across the Atlantic with three gallant companions.

"Now, when he returns from exploring the Antarctic Continent, mapping vast areas hitherto unseen, discovering great mountain ranges and charting coast lines, bringing scientific data of extreme importance, as well as accomplishing the first flight to the South Pole, we are under the pleasant compulsion of devising a new award for him—a Special Gold Medal of Honor.

"To-night he can only summarize the geographic information he and his associates have accumulated; but his first concern, the first day he set foot on American soil, was to begin writing for his and our National Geographic Society a complete account of the discoveries and activities of



Wide World Photograph

ADMIRAL BYRD AND HIS ANTARCTIC COMMAND ARE RECEIVED AT THE WHITE HOUSE

All of the 42 members of the ice party who spent 14 months in the Antarctic, as well as members of the crews of the expedition's ships, *City of New York* and *Eleanor Bolling*, were received at the White House before attending the luncheon arranged in their honor by the Board of Trustees of the National Geographic Society (see text, page 232). In the central group, left to right, Acting Secretary of the Navy Jahncke (in white), Dr. Gilbert Grosvenor, Dr. John Oliver La Gorce, President Hoover greeting Bernt Balchen, chief pilot of the South Polar flight, and, to the President's left, Admiral Byrd.

his expedition. This epic narrative will be published for the National Geographic Society's membership in the August issue of their Magazine.

"As we greet him, we also congratulate and honor every man of his expedition. It is with much pleasure we see on our platform every member of this marvelous aggregation of executive, seafaring, and scientific talent—eighty courageous explorers.

"To add significance to the award to be conferred on the distinguished leader, the Board of Trustees invited President Hoover to bestow the medal. It is especially appropriate that this presentation should be made by President Hoover, for the ceremony thus becomes a tribute of one experienced world traveler to another.

"A map of the travels of Herbert Hoover shows he has spanned the globe from Australia to Alaska, from Santiago to Vladivostok; from Cape Town to Bergen, Norway. He has crossed the Atlantic more than twenty-five times; he has traversed the Pacific at least ten times, and has circumnavigated the earth repeatedly.

"It is almost literally true that there are only two places in the world the President has not visited—the North Pole and the South Pole. If there had been starving children or unhappy human beings to relieve at those bleak places, it is probable that Herbert Hoover would have managed to get there somehow.

"We regret that Mrs. Hoover is unable to be present this evening. Members of the National Geographic Society take much pride in the fact that Mrs. Hoover has been a member of our Society for 28 years. She joined The Society April 18, 1902, when it was a small band of 2,500 members. In intervening years, wherever she has traveled, THE GEOGRAPHIC has been forwarded to her—sometimes to very remote places. Few membership records of our 1,250,000 members show more frequent changes in forwarding addresses than those of Mrs. Hoover. For her encouragement and interest all these years, the officers accord their respectful appreciation.

"We thank you, Mr. President, for your kindness in coming to our meeting, and thereby adding to those precious traditions which give strength and permanence to the National Geographic Society.

"Ladies and gentlemen, the President of the United States."

PRESIDENT HOOVER WELCOMES THE EXPLORER IN THE NAME OF THE NATION

President Hoover, in presenting The Society's medal, said:

"I am glad to welcome Admiral Byrd back to Washington. I speak not merely for the National Geographic Society and myself, but for the Nation as a whole and for every individual citizen. His contribution to exploration and scientific research has done honor to his country, and his country takes a just pride in them and in him. More than that, his daring and courage have thrilled each one of us individually, because he has proved anew the worth and power and glory of qualities which we believe are latent in our people. For men of our race to master extraordinary difficulty, to carry through great adventure, thrills us with pride, with hope, and with confidence. I sometimes think that this is the greatest value of modern explorers.

"I do not minimize the scientific gains of such expeditions, but the human values are so immediate and so universal in their effect that it may well be that they transcend the scientific service. Every hidden spot of the earth's surface remains a challenge to man's will and ingenuity until it has been conquered. Every conquest of such a difficult goal adds permanently to mankind's sense of power and security. Great explorers, therefore, do not merely add to the sum of human knowledge, but also they add immensely to the sum of human inspiration.

"Knowledge, too, has been enriched by Admiral Byrd's expedition. New coasts of the Antarctic Continent have been mapped and new regions have been explored. Geological data have been increased, which contribute to our knowledge of the history of the earth. New knowledge of magnetic currents and of weather changes has been gained. The store of the world's knowledge may not be priced in money, for money we make and spend, but knowledge remains always with the race.

"All these achievements are the capstone of a career whose progress Americans have watched with interest and pride. Admiral Byrd has been first to conquer

the difficulties of reaching the Poles by heavier-than-air flying. He has flown the Atlantic Ocean. Success has followed upon success in his life, and this is the greatest of all.

"As with all consistently successful issues, his accomplishments have been built upon painstaking preparation, foreknowledge of the special problems to be solved, thoughtful plans to meet them, and infinite patience in preparation and infinite patience in execution. He has demonstrated the traits of the born commander—boldness at the right time, comradeship, those heroic qualities that endear the captain to his men. And he is beloved by the American people.

"I congratulate you, Admiral Byrd, upon your success, upon your safe return to your country and home and friends, upon your services and the lift you have given to the spirit of your countrymen. I am happy to present to you this Special Gold Medal of the National Geographic Society, awarded to you for 'the first attainment of the geographical South Pole by air . . . and for distinguished contributions to world knowledge of Antarctica.' And I take great pleasure in again introducing you formally to this audience, seen and unseen, to whom you need no introduction and to whose hands I now commit the rendering of those further honors which you so highly deserve."

ADMIRAL BYRD THANKS THE SOCIETY

Before entering upon a summary of the expedition's work, Admiral Byrd acknowledged to The Society's membership at the ceremonies, and to the millions of members and their families who listened to the radio broadcast, The Society's contribution and scientific aid to his project. He said:

"I come here to-night with an especial debt of gratitude to Dr. Grosvenor, Dr. La Gorce, and to fellow members of the National Geographic Society. The Society has always been most helpful, with scientific advice, sympathy, and financial support, to my various expeditions.

"In this last expedition The Society exceeded its generosity of the past. Having already contributed $25,000 toward the support of the expedition, it came forward at a critical time, subsequently, with a heartening gift of equal amount.

"So, if I fail to find words properly to express my gratitude for these things, you will understand, I am sure, that in my heart there is the greatest thankfulness."

PICTURES OF EXPEDITION'S WORK TELL GRAPHIC STORY

Following Admiral Byrd's address, the first official showing was given of the motion pictures of the expedition. These motion pictures portrayed the work of the expedition on the ground and in the air, the struggle of the ships with gale and pack ice, the building of the expedition's Antarctic community, the daily life of "Little America," and closed with a graphic reel of the flight to the South Pole. Members of The Society throughout the country are urged to see these remarkable motion pictures of Antarctica.

Admiral Byrd, his command of 79 men, and members of his family came to Washington from New York on a special train, as guests of the National Geographic Society, arriving on Friday morning, June 20.

They were met at the station by Dr. Grosvenor, Dr. La Gorce, Acting Secretary of the Navy Jahncke, the Secretary to the President, Mr. George Akerson; aides from the White House and Navy Department, and escorted to their hotel.

Aboard the train, in addition to the expedition members, were Mrs. Richard Evelyn Byrd and Admiral Byrd's son, Richard Byrd, Jr.; Mrs. Eleanor Bolling Byrd, Admiral Byrd's mother; former Governor Harry Flood Byrd and Mrs. Byrd and their children, Harry Byrd, Jr., and Miss Westwood Byrd; Capt. Thomas Byrd and his daughter, Miss Margaret Byrd, and Capt. Hilton H. Railey, Admiral Byrd's personal representative.

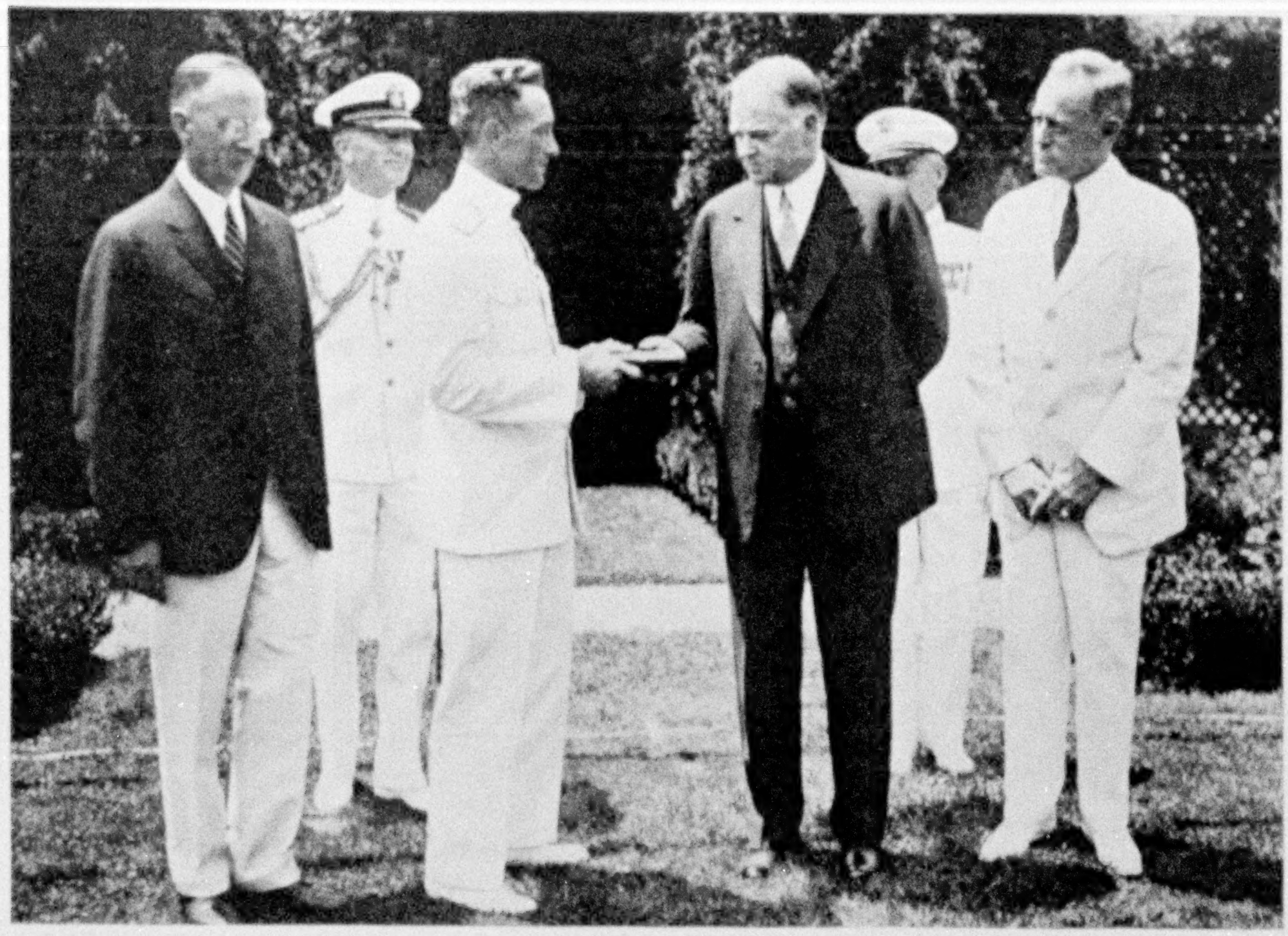
At 12:30 o'clock Admiral Byrd and his command were received at the White House by President Hoover.

HONOR GUEST AT SOCIETY'S LUNCHEON

At 1:30 o'clock the entire party were guests of the Board of Trustees of the National Geographic Society at luncheon. Brief addresses were made by the Vice President of the United States, the Hon. Charles Curtis, and by Acting Secretary of the Navy Jahncke.

In replying, Admiral Byrd said, in part:

"I stand here to-day as the representative of the fine group of men who were with me in the Antarctic, and wish to



International Newsreel Photograph

PRESIDENT HOOVER PRESENTS THE SOCIETY'S MEDAL TO ADMIRAL BYRD

In order that a permanent record might be made of the presentation of the Special Gold Medal of Honor conferred by the National Geographic Society upon Rear Admiral Byrd for "distinguished contributions to knowledge of Antarctica," this daylight scene was arranged for the talking motion pictures, on the White House lawn, prior to the formal ceremonies, on the evening of June 20, in the Washington Auditorium. Left to right: Dr. Gilbert Grosvenor, President of The Society; Comdr. Harold C. Train, naval aide to the President; Rear Admiral Byrd, President Hoover, Col. Campbell B. Hodges, military aide to the President, and the Hon. Ernest Lee Jahncke, Acting Secretary of the Navy.

express for them as well as for myself our humble gratitude for the things you have done for us and the kind things you have just said about us. We have tried to push the frontiers of science into the far south, and we hope that the data that we have brought back will be of some value. It has been a great comfort to us to know that we have had your backing.

"Let me say to you, Mr. Jahncke, that the consciousness of the Navy's continued assistance was always a source of gratification. All that I am I owe to the Navy. It may be interesting to you to know that 30 per cent of our personnel was Navy-trained, and I am proud to say that every one of these men acquitted himself in accordance with the highest Navy traditions.

"And let me express to the Board of Trustees of the National Geographic Society our gratitude for The Society's unfailing help. There were times during the preparation for our work and during its performance when difficulties oppressed us, but always The Society helped us to resolve those difficulties. It was The Society which first made it possible for me to experiment with airplanes for Polar work during its joint expedition with the Navy to northern Greenland in 1925.

"I see here Mr. Albert Bumstead, chief cartographer of the National Geographic Society, and I wish particularly to acknowledge our debt to him. He invented the sun-compass, and it was that instrument that made it possible for us to fly with confidence to the North Pole and to the South Pole and to find our way back to our bases."

By special invitation of the Senate and the House of Representatives, Admiral Byrd and his command visited both

Houses of Congress. The explorer was presented to the Senate by the Vice President and to the House by Speaker Longworth.

PAYS HOMAGE TO OTHER EXPLORERS

Admiral Byrd then paid his official call upon the Secretary of the Navy, and he and his command went to Arlington National Cemetery. There he laid wreaths upon the tombs of Rear Admiral Robert E. Peary, first to attain the North Pole; of Rear Admiral Charles Wilkes, first American to lead a scientific expedition to the Antarctic; Floyd Bennett, Admiral Byrd's beloved flying companion; and of Col. E. Lester Jones, former Director of the U. S. Coast and Geodetic Survey.

After a ride about the city, the party returned to their hotel to rest until the medal presentation ceremonies of the evening.

For the presentation exercises of The Society's Special Medal the largest auditorium in Washington, with a seating capacity of 6,000, was engaged. Announcement of the ceremony was sent to members of Washington and vicinity. Seats were allotted in the order of members' applications. The Trustees regret that, because of the overwhelming demand for seats, some thousands who applied for tickets after every seat had been assigned were unable to attend the ceremonies.

DISTINGUISHED GUESTS PRESENT

Among the highest Government officials present were:

The Vice President of the United States and his sister, Mrs. Edward E. Gann, and Mr. Gann
The Speaker of the House and Mrs. Nicholas Longworth
The Secretary of the Treasury, Hon. Andrew W. Mellon
The Attorney General of the United States, Hon. William D. Mitchell
The Postmaster General and Mrs. Walter F. Brown
The Secretary of the Interior and Mrs. Ray Lyman Wilbur
The Secretary of Agriculture and Mrs. Arthur M. Hyde
The Secretary of Labor and Mrs. James J. Davis

Thirty-two foreign countries were represented by the following ambassadors, ministers, and chargés d'affaires:

The Ambassador of Mexico and Señora de Téllez
The Ambassador of Spain and Señora de Padilla
The Ambassador of France, M. Paul Claudel
The Ambassador of Turkey, Mr. Ahmet Muhtar
The Ambassador of Germany, Herr Friedrich von Prittwitz und Gaffron
The Minister of Uruguay, Dr J Varela
The Minister of Switzerland and Madame Peter
The Minister of Finland, Mr. L. Åström
The Minister of Panama and Señora de Alfaro
The Minister of Greece and Madame Simopoulos
The Minister of Austria and Madame Prochnik
The Minister of Bulgaria and Madame Radeff
The Minister of Sweden, Mr. W. Boström
The Minister of the Netherlands and Madame van Royen
The Minister of Norway and Madame Bachke
The Minister of Guatemala and Señora de Recinos
The Minister of Bolivia and Señora de Diez de Medina
The Minister of Czechoslovakia, Mr. Ferdinand Veverka
The Minister of China and Madame Wu
The Minister of Nicaragua and Señora de Sacasa
The Minister of Siam, Major General Prince Amoradat Kridakara
The Minister of Honduras and Señora de Argueta
The Minister of Ecuador and Señora de Viteri
The Minister of the Union of South Africa and Mrs. Louw
The Minister of the Dominican Republic and Señora de Brache
The Chargé d'Affaires of Peru, Señor J. Alvarez de Buenavista
The Chargé d'Affaires of Chile, Señor Don Oscar Blanco Viel
The Chargé d'Affaires of Argentina and Señora de Enciso
The Chargé d'Affaires of Venezuela, Señor Don Luis Churion
The Chargé d'Affaires of El Salvador and Señora de Leiva
The Chargé d'Affaires of Paraguay and Señora de Ynsfran
The Chargé d'Affaires of Egypt and Madame Aly Ismail Bey

The 31 United States Senators present were:

Senator and Mrs. Henry J. Allen
Senator and Mrs. Hiram Bingham
Senator William E. Borah
Senator and Mrs. Edwin S. Broussard
Senator Arthur Capper
Senator and Mrs. Royal S. Copeland
Senator and Mrs. Porter H. Dale
Senator and Mrs. Charles S. Deneen
Senator Simeon D. Fess
Senator and Mrs. Duncan U. Fletcher
Senator and Mrs. Carter Glass
Senator and Mrs. Frank L. Greene
Senator and Mrs. Daniel O. Hastings
Senator and Mrs. Carl Hayden
Senator and Mrs. Robert B. Howell
Senator and Mrs. Wesley L. Jones
Senator John B. Kendrick
Senator and Mrs. Henry W. Keyes

Laura Gardin Fraser, sculptor

THE NATIONAL GEOGRAPHIC SOCIETY'S SPECIAL MEDAL OF HONOR

In addition to the profile bust of Admiral Byrd and the inscription of award, the face of the medal bears the two stars and anchor of a rear admiral's insignia and the wings, shield, and anchor of a naval aviator. On the reverse side is a winged man conquering the Poles.

Senator and Mrs. Jesse H. Metcalf
Senator and Mrs. Lee S. Overman
Senator and Mrs. Lawrence C. Phipps
Senator and Mrs. Key Pittman
Senator and Mrs. Joseph E. Ransdell
Senator and Mrs. David A. Reed
Senator and Mrs. Morris Sheppard
Senator Frederick Steiwer
Senator and Mrs. Elmer Thomas
Senator Robert F. Wagner
Senator and Mrs. Frederic C. Walcott
Senator Thomas J. Walsh
Senator and Mrs. James E. Watson

The House of Representatives had 62 members present:

Rep. Ernest R. Ackerman
Rep. Charles Adkins
Rep. James M. Beck
Rep. and Mrs. Sol Bloom
Rep. and Mrs. Fred A. Britten
Rep. and Mrs. John L. Cable
Rep. C. A. Christopherson
Rep. Cyrenus Cole
Rep. and Mrs. Don B. Colton
Rep. and Mrs. Louis C. Cramton
Rep. Francis D. Culkin
Rep. Charles F. Curry
Rep. Frederick M. Davenport
Rep. and Mrs. Wallace S. Dempsey
Rep. and Mrs. Cassius C. Dowell
Rep. and Mrs. Richard N. Elliott
Rep. and Mrs. E. Hart Fenn
Rep. and Mrs. Roy G. Fitzgerald
Rep. Frank H. Foss
Rep. A. M. Free
Rep. Ernest W. Gibson
Rep. George S. Graham
Rep. and Mrs. Arthur H. Greenwood
Rep. Guy U. Hardy
Rep. Gilbert N. Haugen
Rep. and Mrs. Willis C. Hawley
Rep. and Mrs. W. Frank James
Rep. and Mrs. Albert Johnson
Rep. N. J. Johnson
Rep. and Mrs. Royal C. Johnson
Rep. Florence Kahn
Rep. and Mrs. Bolivar E. Kemp
Rep. Charles E. Kiefner
Rep. Paul John Kvale
Rep. and Mrs. Scott Leavitt
Rep. and Mrs. F. R. Lehlbach
Rep. F. Dickinson Letts
Rep. S. D. McReynolds
Rep. Franklin Menges
Rep. J. L. Milligan
Rep. Frank Murphy
Rep. and Mrs. John M. Nelson
Rep. and Mrs. James S. Parker
Rep. Edward W. Pou
Rep. and Mrs. Henry T. Rainey
Rep. T. J. B. Robinson
Rep. and Mrs. Addison T. Smith
Rep. Donald F. Snow
Rep. John C. Speaks
Rep. U. S. Stone
Rep. and Mrs. James G. Strong
Rep. John W. Summers
Rep. Maurice H. Thatcher
Rep. and Mrs. John Q. Tilson
Rep. and Mrs. Allen T. Treadway
Rep. and Mrs. Henry St. George Tucker
Rep. and Mrs. Albert H. Vestal
Rep. Henry W. Watson
Rep. W. M. Whittington
Rep. and Mrs. William Williamson

Rep. William R. Wood
Rep. and Mrs. Frederick N. Zihlman

The State Department was represented by:

Assistant Secretary of State and Mrs. Francis White
Solicitor of the Department of State and Mrs. Green H. Hackworth
Chief of Division of Foreign Service Administration, Mr. Herbert C. Hengstler
Consul General George C. Hanson
Geographer of the State Department and Mrs. Samuel W. Boggs

In addition to Secretary Mellon, the Treasury Department was represented by:

Assistant Secretary of the Treasury and Mrs. Walter E. Hope
Assistant Secretary of the Treasury, Hon. Ferry K. Heath
Assistant Secretary of the Treasury and Mrs. Seymour Lowman
Treasurer of the United States and Mrs. W. O. Woods
Director of the Mint and Mrs. Robert J. Grant
Surgeon General and Mrs. Hugh S. Cumming

The War Department representatives, including 29 Generals, were:

Assistant Secretary and Mrs. Frederick H. Payne
Major General Fred T. Austin
Major General and Mrs. Lytle Brown
Major General Omar Bundy
Major General John Lincoln Clem
Major General and Mrs. Herbert B. Crosby
Major General and Mrs. Hugh A. Drum
Major General and Mrs. Amos A. Fries
Major General and Mrs. Stephen O. Fuqua
Major General P. C. Harris
Major General and Mrs. Guy V. Henry
Major General W. A. Holbrook
Major General and Mrs. Merritte W. Ireland
Major General and Mrs. Edward A. Kreger
Major General and Mrs. Henry P. McCain
Major General Charles T. Menoher
Major General J. F. Morrison
Major General and Mrs. Mason M. Patrick
Major General David C. Shanks
Major General Kenzie W. Walker
Brigadier General and Mrs. D. L. Brainard
Brigadier General A. C. Dalton
Brigadier General Henry C. Fisher
Brigadier General and Mrs. William E. Gillmore
Brigadier General and Mrs. Frank T. Hines
Brigadier General J. T. Kerr
Brigadier General Michael J. Lenihan
Brigadier General James F. McKinley
Brigadier General Harry F. Rethers
Brigadier General Timothy E. Wilcox

In addition to the Postmaster General, representatives of the Post Office Department were:

First Assistant Postmaster General and Mrs. Arch Coleman
Second Assistant Postmaster General and Mrs. Warren Irving Glover
Third Assistant Postmaster General and Mrs. Frederic A. Tilton
Fourth Assistant Postmaster General and Mrs. John W. Philp

Besides the Acting Secretary, the Navy Department's representatives, including 36 Admirals, and 6 Generals from the Marine Corps, were:

Rear Admiral and Mrs. W. S. Benson
Rear Admiral J. D. Beuret
Rear Admiral and Mrs. Frederick C. Billard
Rear Admiral and Mrs. Mark L. Bristol
Rear Admiral and Mrs. Washington L. Capps
Rear Admiral Joseph Johnston Cheatham
Rear Admiral George R. Clark
Rear Admiral and Mrs. Hutch I. Cone
Rear Admiral and Mrs. Robert E. Coontz
Rear Admiral and Mrs. Walter R. Gherardi
Rear Admiral L. E. Gregory
Rear Admiral R. S. Griffin
Rear Admiral J. N. Hemphill
Rear Admiral T. H. Hicks
Rear Admiral Henry Hughes Hough
Rear Admiral John Hubbard
Rear Admiral and Mrs. Hilary P. Jones
Rear Admiral and Mrs. Robert M. Kennedy
Rear Admiral Sumner E. W. Kittelle
Rear Admiral and Mrs. William D. Leahy
Rear Admiral Charles H. T. Lowndes
Rear Admiral and Mrs. Ridley McLean
Rear Admiral and Mrs. Luke McNamee
Rear Admiral Albert Mertz
Rear Admiral and Mrs. William A. Moffett
Rear Admiral Harold P. Norton
Rear Admiral and Mrs. Charles E. Riggs
Rear Admiral and Mrs. George H. Rock
Rear Admiral and Mrs. Harry H. Rousseau
Rear Admiral and Mrs. David F. Sellers
Rear Admiral and Mrs. William H. Standley
Rear Admiral D. D. V. Stuart
Rear Admiral and Mrs. Frank B. Upham
Rear Admiral Arthur Lee Willard
Rear Admiral Clarence S. Williams
Rear Admiral and Mrs. Harry E. Yarnell
Captain and Mrs. Harry A. Baldridge
Captain and Mrs. Joel T. Boone
Captain and Mrs. Byron McCandless
Captain Yancey S. Williams
Lieut. Comdr. J. E. Ostrander
Major General and Mrs. Smedley D. Butler
Major General John A. Lejeune
Brigadier General and Mrs. Ben H. Fuller
Brigadier General and Mrs. Rufus H. Lane
Brigadier General and Mrs. Hugh Matthews
Brigadier General and Mrs. George Richards

In addition to the Secretary, representatives of the Department of the Interior included:

Commissioner Bureau of Indian Affairs, Mr. Charles J. Rhoads
Commissioner of Education and Mrs. William J. Cooper
Director of the U. S. Geological Survey and Mrs. George Otis Smith
Commissioner Bureau of Reclamation and Mrs. Elwood Mead
Director of the National Park Service and Mrs. Horace M. Albright.

Representatives of the Department of Agriculture, in addition to Secretary Hyde, were:

Chief Bureau of Animal Industry and Mrs. John R. Mohler
Chief Bureau of Dairy Industry, Mr. O. E. Reed
Chief of Forest Service and Mrs. R. Y. Stuart
Chief of Bureau of Chemistry and Soils and Mrs. Henry G. Knight
Chief of Bureau of Biological Survey and Mrs. Paul G. Redington
Chief of Bureau of Public Roads and Mrs. Thomas H. MacDonald

Representatives of the Department of Commerce:

Assistant Secretary and Mrs. Julius Klein
Director of Aëronautic Development and Mrs. Harry H. Blee
Chief of Airways Division and Mrs. F. C. Hingsburg
Chief of Aëronautic Research Division and Mrs. L. J. Briggs
Chief of Radio Division and Mrs. William D. Terrell
Director Bureau of Census and Mrs. William M. Steuart
Director Bureau of Foreign and Domestic Commerce and Mrs. William L. Cooper
Director of the Bureau of Standards and Mrs. George K. Burgess
Commissioner of the U. S. Bureau of Lighthouses and Mrs. George R. Putnam
Director of the U. S. Coast and Geodetic Survey and Mrs. Raymond S. Patton
Chief of Division of Geodesy and Mrs. William Bowie
Commissioner of Patents and Mrs. Thomas E. Robertson
Director of Bureau of Mines and Mrs. Scott Turner
Geographer of the Department of Commerce, Dr. Helen M. Strong

In addition to Secretary Davis, representatives of the Labor Department were:

Assistant Secretary and Mrs. Robe Carl White
Second Assistant Secretary and Mrs. W. W. Husband
Commissioner General Bureau of Immigration and Mrs. Harry E. Hull
Commissioner of Naturalization and Mrs. Raymond F. Crist

Representatives from the Smithsonian Institution and Government bureaus under its direction:

Secretary of the Smithsonian Institution and Mrs. C. G. Abbot
Assistant Secretary of the Smithsonian Institution and Mrs. Alexander Wetmore
Chief Bureau American Ethnology, Mr. M. W. Stirling
Director of the National Zoölogical Park and Mrs. William M. Mann

Representatives of Federal commissions, bureaus, and other organizations:

Secretary of the National Research Council and Mrs. Vernon Kellogg
Dr. L. S. Rowe, Director General of the Pan American Union
Counselor of the Pan American Union and Mrs. Franklin Adams
Comptroller General of the United States and Mrs. J. R. McCarl
President of the Civil Service Commission, Mr. William C. Deming
Interstate Commerce Commissioner and Mrs. Balthasar H. Meyer
Interstate Commerce Commissioner and Mrs. Clyde B. Aitchison
Interstate Commerce Commissioner and Mrs. Ernest I. Lewis
Interstate Commerce Commissioner and Mrs. Thomas F. Woodlock
Interstate Commerce Commissioner and Mrs. Ezra Brainerd, Jr.
Interstate Commerce Commissioner and Mrs. Claude R. Porter
Interstate Commerce Commissioner and Mrs. Patrick J. Farrell
Chairman of the Federal Trade Commission and Mrs. Garland S. Ferguson, Jr.
Chairman of the United States Shipping Board and Mrs. T. V. O'Connor
Alien Property Custodian and Mrs. Howard Sutherland
Chairman of the United States Tariff Commission and Mrs. Edgar B. Brossard
Vice Chairman of the United States Tariff Commission and Mrs. Alfred P. Dennis
Chairman of the American National Red Cross, Mr. John Barton Payne
Chairman National Capital Park and Planning Commission and Mrs. Frederic A. Delano
Director Public Buildings and Public Parks, Lieut. Col. U. S. Grant, 3d, and Mrs. Grant
Chairman of the Federal Radio Commission and Mrs. Ira E. Robinson
Public Printer and Mrs. George H. Carter

Officials of the District Government present were:

Associate Justice of the Court of Appeals of the District of Columbia and Mrs. Josiah A. Van Orsdel
Associate Justice of the Supreme Court of the District of Columbia, Hon. Wendell P. Stafford
Judge and Mrs. Isaac R. Hitt
President of the Board of Commissioners and Mrs. Luther H. Reichelderfer
Engineer Commissioner and Mrs. William B. Ladue
The Superintendent of District Schools and Mrs. Frank W. Ballou
District Corporation Counsel and Mrs. William W. Bride
Executive Secretary of the Public Utilities Commission and Mrs. Earl V. Fisher
Postmaster of Washington and Mrs. William M. Mooney

Among other distinguished guests present were:

Mrs. Charles Francis Adams, wife of the Secretary of the Navy
Sergeant at Arms of the U. S. Senate and Mrs. David S. Barry
Mr. Van Lear Black, transcontinental flyer
Dr. J. A. C. Chandler, President of William and Mary College
Mr. and Mrs. Raymond Clapper
Mr. and Mrs. Arthur J. Condon
Dr. and Mrs. Frederick V. Coville
Secretary of the National Education Association and Mrs. J. W. Crabtree
Mrs. William R. Eaton, wife of Representative Eaton of Colorado
Mr. John Joy Edson
Mr. and Mrs. Robert V. Fleming
Dr. and Mrs. John Foote
Dr. J. Howard Gore
Miss Rose Greely
Mr. and Mrs. George R. Holmes
Mrs. Patrick J. Hurley, wife of the Secretary of War
Miss Ruth Eleanor Jones
Mr. and Mrs. Oliver Owen Kuhn
Mr. and Mrs. David Lawrence
Mr. and Mrs. G. A. Lyon, Jr.
Mr. and Mrs. John B. Lyon
President of George Washington University and Mrs. Cloyd H. Marvin
Dr. and Mrs. C. Hart Merriam
President of Carnegie Institution of Washington and Mrs. John C. Merriam
President of Georgetown University, the Rev. Dr. W. Coleman Nevils, S. J.
Secretary to the President and Mrs. Walter H. Newton
Dean of the School of Foreign Service, Georgetown University, and Mrs. William F. Notz
Mr. Theodore W. Noyes
Mr. and Mrs. Richard V. Oulahan
Clerk of the House of Representatives, Mr. William Tyler Page
Mrs. Robert E. Peary
Mrs. S. V. H. Pickett
Mr. and Mrs. Byron Price
Secretary to the President, Mr. Lawrence Richey
Rev. Dr. Joseph R. Sizoo
Administrative Assistant to the President and Mrs. French Strother
Mr. and Mrs. Leroy T. Vernon
Mr. and Mrs. Theodore Wallen
Mr. Frederic William Wile
Mr. and Mrs. Lloyd B. Wilson

ALL OF THE ICE PARTY PRESENT

The 42 members of the expedition who spent 14 months on the ice and who were present on this occasion with their leader were:

Dr. L. M. Gould, second in command, geologist and geographer
Capt. A. C. McKinley, third in command, aërial surveyor
William C. Haines, fourth in command, meteorologist
Prof. Frank T. Davies, physicist
Dr. F. D. Coman, medical officer
Bernt Balchen, chief pilot
H. I. June, pilot
D. C. Smith, pilot
Capt. A. N. Parker, pilot
George H. Black, supply officer
H. T. Harrison, Jr., aërologist
Russell Owen, news correspondent
W. B. Van der Veer, motion-picture photographer
Joseph T. Rucker, motion-picture photographer
Martin Ronne, tailor
Charles E. Lofgren, personnel officer
John S. O'Brien, surveyor
George A. Thorne, surveyor, dog driver
James A. Feury, snowmobile operator
Jacob Bursey, dog driver
Christoffer Braathen, dog driver, ski expert
Quin A. Blackburn, surveyor
Paul A. Siple, Boy Scout
Arthur T. Walden, in charge of dogs
Frederick E. Crockett, dog driver
Norman D. Vaughan, dog driver
Edward E. Goodale, dog driver
Joe de Ganahl, dog driver, navigator
Arnold H. Clarke, assistant to physicist
George W. Tennant, cook
Claire D. Alexander, assistant tailor
Kennard F. Bubier, aviation mechanic
Benjamin Roth, aviation mechanic
E. J. Demas, aviation mechanic
T. B. Mulroy, fuel engineer
Lieut. Malcolm P. Hanson, radio engineer
Carl O. Petersen, radio operator
Howard F. Mason, radio operator
Sverre Strom, ice pilot
Victor H. Czegka, machinist
Charles F. Gould, carpenter

Members of the *City of New York* crew who were present were:

Capt. Frederick Melville, master
Bendik Johansen, ice pilot
William Erickson, deck officer
Esmond O'Brien, engineer
John J. Bayer, engineer
John Sutton, engineer
Ralph Shropshire, hydrographer
Lloyd Berkner, radio operator
Arthur Berlin, fireman
Richard Kontor, seaman
V. Vojtech, scientist
J. Bird, ornithologist
Walter Luethner, cook
Edward Roose, seaman
J. (Lofty) Robinson, fireman
W. Gribben

The personnel of Admiral Byrd's second ship, the *Eleanor Bolling*, were represented by:

Capt. Gustav L. Brown, master
Charles McGuinness, chief officer
Lieut. Harry Adams, second officer
Lloyd Grenlie, radio operator
Frank McPherson, chief engineer
Elbert J. Thawley, engineer
Leland Barter, engineer
Carroll B. Foster, fireman
Louis Reichart, cook
Charles Kessler, John Buys, William Gawronski, Anson W. Perkins, W. H. Kelley, F. Paape, J. W. Morrison, P. J. Hart, M. W. Dobston, W. Hamilton, T. M. Royal, H. L. Willcox, and H. N. Shrimpton, seamen.

WORKING TEAK IN THE BURMA FORESTS

The Sagacious Elephant Is Man's Ablest Ally in the Logging Industry of the Far East

By A. W. Smith

TWO years after the Armistice, finding peace-time conditions in the British Army dull and unprofitable, I decided to make a change. In seven years I had been on active service in France, Russia, and India. In those seven years I had cultivated a taste for the open air, a distaste for the confinement of an office, and an ability to look after myself under any conditions.

As luck would have it, the opportunity of a post with one of the big firms working teak in the forests of Burma arrived at the psychological moment. I had heard the life was hard and lonely, but varied and interesting, and I decided to apply.

I was a little surprised, when I was interviewed in the London office of the firm, at the eagerness with which some of its members tried to dissuade me from entering their employment. A year later, after four months without seeing a white man or speaking my own language, I began to understand. There were to be no complaints of having been taken on under false pretenses.

I was accepted.

SIX MONTHS' SUPPLIES FOR THE FOREST

Two months later, in the cool of the Rangoon office, with the big matting fans swinging rhythmically overhead, I sat opposite the manager of the firm. He had been talking for half an hour of the work before me, talking casually in terms of elephants and their ways, as a farmer would talk of his horses. He tipped back in his chair and flicked the ash off his cigarette.

"Well, that is all, I think. You had better order your stores here. You will need six months' supply."

I tried to do mental arithmetic to arrive at how much I should need. I had been in remote places in India, but nowhere had I found myself seriously out of reach of flour, meat in some form, eggs, and milk. Six months' stores could only mean stores of those luxuries intended to perk up an appetite jaded by hot weather.

I hazarded a question.

The manager cocked an eye at me.

"Bazaars? Oh, didn't I tell you? You will be out of reach of any kind of stores, and the only things you can bet on getting are chickens. You will have to have everything else."

He pressed his bell and handed me over to an efficient little Chinese clerk. Together we went out into the hot sunshine.

The clerk seemed to have done that kind of thing before. A quarter of an hour in the office of a big store served to provide me with everything, from cartridges for my rifle to dried hops for rising my bread for the next six months.

I had little to do with it. Occasionally I was allowed to state a preference—for a certain brand of cartridges, for instance, or for the tobacco I liked. Six months' groceries and canned goods passed to me without delay or bother, and when the six months were ended all I had left was some chocolate.

WHERE THE TEAK TREE GROWS

Away upcountry in Burma, miles inland from Rangoon and Moulmein, are vast areas of tumbled hills covered with heavy tropical forest and slashed with deep valleys. Full-grown rivers roar in rocky ravines into black, oily whirlpools and disappear for a mile, only to reappear, boiling and frothing, at the foot of a cliff.

Creeks, almost dry in the hot weather, rise twenty feet in a day three or four times in the rainy season, and come down yellow and thick, only to dwindle away again to mere threads of water in the course of a few hours.

It is in country of this kind, remote and uninhabited, that the teak tree grows. Nowhere, however, is it common. It grows sparsely scattered over the hillsides, one of a dozen and more commoner species of huge forest trees, and a teak forest 10,000 square miles in extent may be capable of producing only seven or eight thousand trees a year.

Photograph by A. W. Smith

A JUNGLE BLACKSMITH AT WORK

No more elaborate workshop than this is required to keep an elephant camp in full order. Squatting on his heels, the blacksmith is at work repairing a *dah*, the cutting knife of the jungle, in the use of which every Burman is expert. Air is supplied to the charcoal furnace on the right from the bellows, made of two bamboo pipes placed vertically behind it. The bellows blower finds it a whole-time job to work the rods which operate the plungers.

The broad waters of the Irrawaddy run due north and south. To the east and west of the wide, fertile plain in which it has its course lie rugged jungle-clad hills. Some 400 miles north from Rangoon the Chindwin, no mean stream in itself, runs into the Irrawaddy from the west. This river has its beginnings some hundreds of miles away to the north, in a wild country inhabited by Naga tribespeople. To the west of it lie the Chin Hills. It was to the foothills of the Chin Hill mountain range that I was sent to be broken in to the work.

The first part of the journey was by train, until I reached the Chindwin River. Then I transferred to a flat-bottomed steamer, a stern-wheeler, 125 feet in length, but drawing barely two feet fully laden. The engine and boilers were distributed stern and bow. She had a stove-pipe funnel, and forward, on the upper deck, were the first-class cabins, three on each side, and a wide veranda deck, with dining table and comfortable chairs. For three days she forced her way up, twisting and turning to avoid sand banks and shallows, following a course marked by painted bamboo channel buoys.

STRUGGLES WITH THE DIFFICULT BURMESE LANGUAGE

I worked four hours each morning trying to make a beginning with my Burmese. For days the round letters all looked alike to me and the language seemed no more than a collection of singsong vowels. Of the eight or nine languages, ancient and modern, Asiatic and European, I have learned or tried to learn, Burmese is the most difficult.

Lessons became more than difficult, with the cool wind blowing the pages of the book, and every brown, high-sterned boat steered by an ancient under an umbrella, every timber raft on its way down the river new and exciting.

We tied up each day at dusk, and at dawn the winches took in the mooring

chains grumblingly, link by link. When lessons were over, I lay in a steamer chair watching the high jungle trees slip by, wondering what was ahead.

I left the steamer at the village of Kalewa, at the junction of the Chindwin and the Myittha rivers. A day later I walked into my first jungle camp, accompanied only by a Burman from a jungle village in the Chin Hills.

I found camp ready, two tents pitched side by side; also the manager of the forest to which I had been appointed — short, stocky, and a rather silent man.

It was a little disappointing. I had expected to see elephants everywhere, to see something of the hardship I had heard so much about. Instead, we had dinner perfectly cooked and served, on china and a white tablecloth. It took me until the hot dry winds began to blow in March to realize that all these things contribute to a good appetite, and an appetite is essential to health when one is in one's second or third month of loneliness in the enervating climate of the Tropics. At the moment, however, I wondered why I was being paid so highly to live so attractive a life.

Photograph by A. W. Smith

A NEWLY GIRDLED TEAK TREE

Three years before it is to be felled, the Government Forest Department kills the teak tree by cutting a ring through the sapwood around the base. It is essential that the sap dry out, for the green wood will not float, and flotation is necessary to get the logs down to Rangoon. The Burmese characters on the blaze show the year of girdling and the mark of the forest officer in charge.

"You will see all the elephants you want in the next month or two," my manager said, "and unless you are a born elephant master you may begin to get tired of looking over backs and feet and seeing that saddlery fits."

Now, at the time of writing, I conclude that I must be a born elephant master, for I never tired of it, though I have never attained to any great heights of skill or knowledge in elephant management.

ELEPHANTS AS A LIFE WORK

As we sat in camp there on the Myittha, I learned the first I knew about elephants from a man who had handled them for twenty years and more. In his forest he had 200 and he knew each one by sight. He could give figures for his elephant

Photograph by A. W. Smith

A HALT FOR BREATH BESIDE A FOREST POOL

The heavy saddles of the elephants are padded with several layers of an astringent bark to prevent galling the back. The breast straps, plaited out of bark rope by the riders themselves, are well dressed with pig's fat imported from Chicago (see text, page 244).

mortality over the last ten years—a decimal point or two above or below 3 per cent per annum. He could give statistics of all kinds. Elephants were his life work.

We were to march the following day with elephants—one old animal past timber work and two half-grown youngsters apiece.

These baggage elephants are technically known as "travelers." They would be in before dawn to load the camp. Two hours before dawn the riders would leave camp to round them up, for they had been let loose in the jungle to forage for themselves on young bamboo and wild plantain, shackled only by chain fetters round the forefeet.

They seldom wander far afield, but should they do so a long trailing chain is attached to the fetters, which makes an unmistakable track in the thick, rank growth of the jungle. Each animal, too, is provided with a cleverly contrived wooden bell which gives out a resonant note with every movement.

An hour before dawn I rose shivering, for the December air is keen and exhilarating. I dressed myself in shirt and blue-flannel shorts cut off above the knee, puttees and boots, threw back the flap of my tent, and stepped out into the dark of the early dawn.

A thick mist covered everything, but the fire of last night was still glowing. I found the manager already up, rousing the flames to a blaze.

The jungle was very still; it was just beginning to grow faintly light. Around us from the high trees great drops of dew fell on the broad leaves covering the ground. One of the Burmese servants was chopping wood. Bacon was sizzling audibly in the "kitchen," thirty yards away.

"Do you know what that is?" the manager asked. I listened. Deep in the jungle I heard a faint "tickety-tok-tok-tok"; then the crack of a breaking branch.

"No," I said.

"Those are the elephant bells. Let's go and have breakfast."

It began to grow light. The elephant bells sounded nearer. The tree limbs were shadowy in the mist, the river smoked under the bank. Then out of the white mist came the travelers, six of them, tall and unreal in the shadowy dark. On each animal's neck sat its driver, and on each back was the huge basket in which all our worldly goods would travel.

Silently, on broad, padded feet, they walked into the cleared circle of the camp, dignified but with a curious swaying motion. Obedient to a word, they squatted.

CAMP LIFE IN THE JUNGLE

For two months I traveled in company with my manager through the rugged Chindwin country. Each day took us farther afield and showed me something new. I began to get a knowledge of the language, and with it an insight into jungle work.

A knowledge of Burmese is a necessity for every jungle man and it entails many months of hard and serious work. It is a difficult language in itself, a language that depends on an infinite variety of vowel sounds that, written in English character, all have the same appearance.

Nor can one learn only the language and leave it at that. The script, too, has to be mastered, for nearly every Burman has learned to read and write in a Buddhist monastery school, and it is essential to be able to deal with the pencil scrawls that pass the news from camp to camp. The script, a succession of circles, has developed from the fact that before the advent of paper all writing was scratched on palmyra palm leaves with a sharp-pointed stylus. A straight line would immediately cut through between the ribs of the leaf.

Nightly a circle of Burman headmen gathered round our fire and slowly the talk passed. It centered on the work in hand, but occasionally one got a story or interesting scrap of gossip.

The workers in the Burmese forest are by no means the wild savages one might suppose. They are intelligent—that is to say, intelligent in the things that matter to them. The jungle is an open book. They can read the story contained in tracks and in broken branches, in the mud settling in waters still disturbed by the passage of a wild beast, in a nibbled blade of grass, in the cracking of a twig.

They know the elephant and his ways. With only a *dah*, the broad, heavy jungle knife, they can build a house and thatch it, make a water cup or a pail, kill a fowl and carve it (see page 240).

This, indeed, is the only kind of intelligence which is useful to them.

They are Buddhists to a man, and as such look down on the worshipers of idols and the animists, such as the Chins. They not only can read, but they do read, and often in the evening one can hear, down by the men's fire, the drone of some one reading to himself. They have not yet mastered the art of reading without speaking the words.

The "forest" was divided into two districts, of one of which I was to take charge. Each district was divided into camps of from four to eight elephants and ten to thirty men, each camp under a headman. The camps might be only five or six miles or as much as twenty or thirty miles apart. Each of these had to be visited and the elephants and work inspected.

At dawn we would break camp and, leaving our elephants to march direct to the next camp, we would turn off into the jungle to see the work. We would look for trees to be felled—"girdlings" these are called (see illustration, page 241).

Sometimes we would find the fellers at work with ax and saw. The axes are extremely primitive—a thick cane helve fitted with a hardwood head like a hammer. On the head is fitted a tiny ax blade hardly two inches across. With this unpromising tool the largest trees are felled with speed and accuracy.

THE ELEPHANT DISPENSARY

Generally we would be in camp for lunch at one or two in the afternoon, and after lunch would follow such office work as wages to be paid and reports to be written.

As soon as the sun began to fall to the level of the tree tops, there would be a stroll down to the camp to see the elephants. The riders rode them in procession, and we would have them walked round once to detect lameness. Then each animal knelt in turn, and there followed a detailed examination of backs and eyes,

feet and legs. There might be operations to perform, abscesses to cut, wounds to syringe and dress, medicine to prescribe. A pound of Epsom salts is considered a fair dose.

Most of the elephants were easy enough to handle, but occasionally one would come in, generally an old male, whom it was unsafe to approach unless he was kneeling on the ground.

A bad elephant is provided with a metal bell instead of a wooden one, and sometimes has to be given a second man besides the rider. The second man is armed with a spear, and when he is there all is well; if the spearman is absent for any reason, there is danger.

PIG'S FAT FROM CHICAGO TO EASE THE ELEPHANT'S LOAD

Inspection of saddlery followed. The dragging saddle is made of wood and is padded underneath with several layers of an astringent bark, to prevent sore backs.

The breast bands, nine-inch-wide straps woven by the riders themselves from bark rope, are another source of trouble. They have to fit just so, and be well dressed with pig's fat, which is specially imported for the purpose from Chicago. In the form in which it arrives it is distinctly useful to the Burman as an aid to cooking. We used to circumvent him, however, by tainting each tin with a stick dipped in iodoform.

The men themselves often need doctoring. Generally four ounces of castor oil suffice, but sometimes cases require more attention. One of the first things I was called on to do was to mend a finger terribly crushed by a log. Amputation was all I could suggest. The patient nodded cheerfully. I produced such instruments as I had and set to work. The patient's friends sat around and chaffed him during the operation.

I flatter myself that I made a good job of it, but it took time. At one point I felt some one breathing on my neck as I worked. It was the patient himself, who wished to see what was happening.

I took the last turn of the bandage, put the arm in a sling, and turned to the patient. He was pale but cheerful. I wondered what he would do next. He fished his removed member out of the bowl, wagged it playfully at his friends, and threw it into the fire. As an example of fortitude, I have never seen the like.

EIGHTY ELEPHANTS AND 300 MEN ON PAYROLL

With mid-February the weather began to get warmer. Instead of cold nights, which made one welcome the warmth of the sun, the midday heat began to have a vicious bite. The tingle went out of the air, the water in the creeks receded rapidly and was covered with green scum, the leaves went off the trees, and the bamboos turned yellow. There were all the first signs of the hot weather, and with its advent I was left alone to see what I could do with a district some 3,000 square miles in extent, with 80 elephants and 300 men on the payroll.

At this time of year water is a real difficulty. In the winter, with the creeks full of clear, cold water, the danger is not so great, but in the hot weather disease is always threatening. We always filtered our water and then boiled it, but I used also to see my plates and dishes washed after meals in boiling water tinged with permanganate of potash, as a precaution against water-borne infection.

There was a month's more jungle work, and then all the elephants would be driven in from the forest camps by lack of feed and water. I had to clear up the year's work and see the beasts out into hot-weather camps, on the flats of the bigger rivers, in which the water never failed and where the ten-foot-high elephant grass provided feed the year round.

ALONE IN A HOT-WEATHER CAMP OF THE JUNGLE

In the middle of March the last of the elephants was out and I did a final tour of the district to see that all was in order.

Then I really was alone. True, I had my camp followers with me, men to whom I could talk if I cared and to whom I did talk for the sake of human companionship. Whenever I wished to talk, however, I had laboriously to turn my ideas into Burmese, this in itself involving considerable effort.

For diversion, there was always the work, and plenty of it, and I resorted more and more to the solace of books. The life itself precludes carrying anything like a library, so that I had to read

Photograph by A. W. Smith

CUTTING DRAG-HOLES IN THE END OF A TEAK LOG

Holes cut in this fashion are strong enough to stand the strain of dragging a heavy log over uneven ground. The plaited cane sun-hat is typical of the country.

those books which would offer most solid entertainment in a small space. Classics in pocket editions supplied the need admirably, and I read and reread Thackeray's writings under these conditions.

In the forest, fire is the grave danger these hot months of March, April, and May. The hot, dry winds blow, rustling the dry bones of trees and bamboos, and combustion may occur when the soft wood of a jungle tree branch is rubbed—gently but continuously rubbed—against the hard, siliceous stem of a bamboo. When this happens, the bamboos blaze like tinder, and the racing flames travel until they come to a creek too wide to cross.

All our logs were out of the forest, lying in orderly lines in the dry beds of the creeks, waiting for the first floods of the July rains to take them out to the main river. The only people left in the jungle were the fire watchers, whose business it was to sweep the dead leaves away from the logs to prevent flames reaching them.

In the river camps the riders spent their time weaving new breast ropes, making saddles, and repairing harness.

We all kept an eye open for the first sign of disease. Anthrax is always liable to attack the crowded stationary camps in the hot weather, and when it comes it kills off the beasts like flies. Some forests during my first year lost 10 per cent of their elephants. I was lucky. I did not lose one.

By mid-June the elephants began to return. The jungle was green and lush with young grass and new bamboo. The creeks were running—muddy, it is true, but with water that was drinkable. The sky was heavy and overcast and the air hot and oppressive.

The country waited for the break of the real rains, which would come with a roar, borne on the rush of the southwest wind.

WHEN THE HEAVENS OPENED

In July came the break of the rains. I was in camp on the banks of a creek, a hundred yards wide between the banks, but dry except for a trickle of bad water, which one could cross dry-shod.

On the other side of the creek was an elephant camp, and it was to visit their

work that I crossed early one morning. The skies were lowering when I set out and I planned to be home by noon.

I went up the hillside to where dragging was in progress. Deep in the forest I could hear the tapping of axes, where the fellers were at work.

I had hardly started the ascent when the rain came—steady, blinding sheets of it—from the overladen sky. I went on and found the work I had come to see.

By noon, soaked to the skin after six hours in the rain, I was ready to go back to camp. I slithered down the hill, thinking of dry clothes and hot coffee and an afternoon in a chair with a book.

When I got down to the creek I found it a racing river, yellow and thick, bringing down all the débris of nine months of dry weather. The logs in the creek bed were hardly afloat, one or two were just lifting to the stream, but to cross unaided that hundred yards of teeming water was impossible.

I decided to try it on elephant back and sent in for Hpo Htoke, a big tusker, steady and wise. As I watched the stream, however, the volume of water increased and the logs began to move. Crossing on an elephant was now too risky, and I could do no more than watch. Soon the logs began to bob as they floated; then they moved merrily, crashing together with a sound like thunder, that could be heard above the roar of the water.

THE TEAK BEGINS ITS JOURNEY TO THE OUTSIDE WORLD

I watched until I was dizzy—logs upended, logs sidewise, logs rolling over and over, all going down to Rangoon. I could see through the mist of rain my own camp tantalizingly near, on the other side, and I thought of bottled beer and hot soup as I drank water and ate throat-searing Burmese curry in a headman's hut.

It was a night and a day before I got back to camp, and I went straight to bed with a roaring dose of fever.

When I recovered, after 36 hours of watching the tent walls pump in and out on the waves of fever, the creek had shrunk to nothing again.

But the logs—the logs were gone, borne on the flood to the big river. There they would be caught and made up into rafts of about 125 logs apiece, in charge of crews of four or five men. These rafts would drift down the broad, lazy reaches of the Irrawaddy until they reached the Rangoon River.

Past the city of Rangoon, overtopped by the golden spire of the Great Pagoda, through the lines of shipping, they would be guided by hurrying launches. At length, at the mills, five, six, or seven months after leaving the forest, they would find themselves safely behind the booms waiting for the saws. Their contact with primitive things would be ended. Band saws working under electric power would rip them into material for the shipbuilders of the world.

Many hundred millions of feet of teak are produced in the Rangoon mills annually, most of it to be used locally in India and Burma for housebuilding and furniture. The best, however, is shipped abroad, principally as shipbuilding material. Of all the timbers of the world, teak is the shipbuilders' greatest prize.

TRAINED ELEPHANTS RANGE IN PRICE FROM $500 TO $3,000

Elephants in the service of the teak firms are recruited in various ways. Some are purchased as fully trained workers. There is a well-established market for elephants and they are not in the least difficult to buy. A good tusker, with all the points that go to make a worker, commands any price up to $3,000, while an indifferent animal can be bought for as little as $500. There is as much art in buying an elephant as in buying a horse and there are as many tricks in the trade.

Elephants not purchased are either born in the service or caught wild and trained. It is not at all uncommon for working females to bear calves, and it is thought that they breed as frequently in the semi-captive state in which they live as timber workers as in the true wild state. The period of courtship may be of some duration, the female and the chosen male remaining in company for weeks together. Sometimes the male parents are workers and sometimes wild tuskers that have been attracted by the charms of the females to hang around in the vicinity of the camps.

The period of gestation is about twenty months, although this varies by a month or two either way. As soon as the calf is born he is able to walk and to follow his

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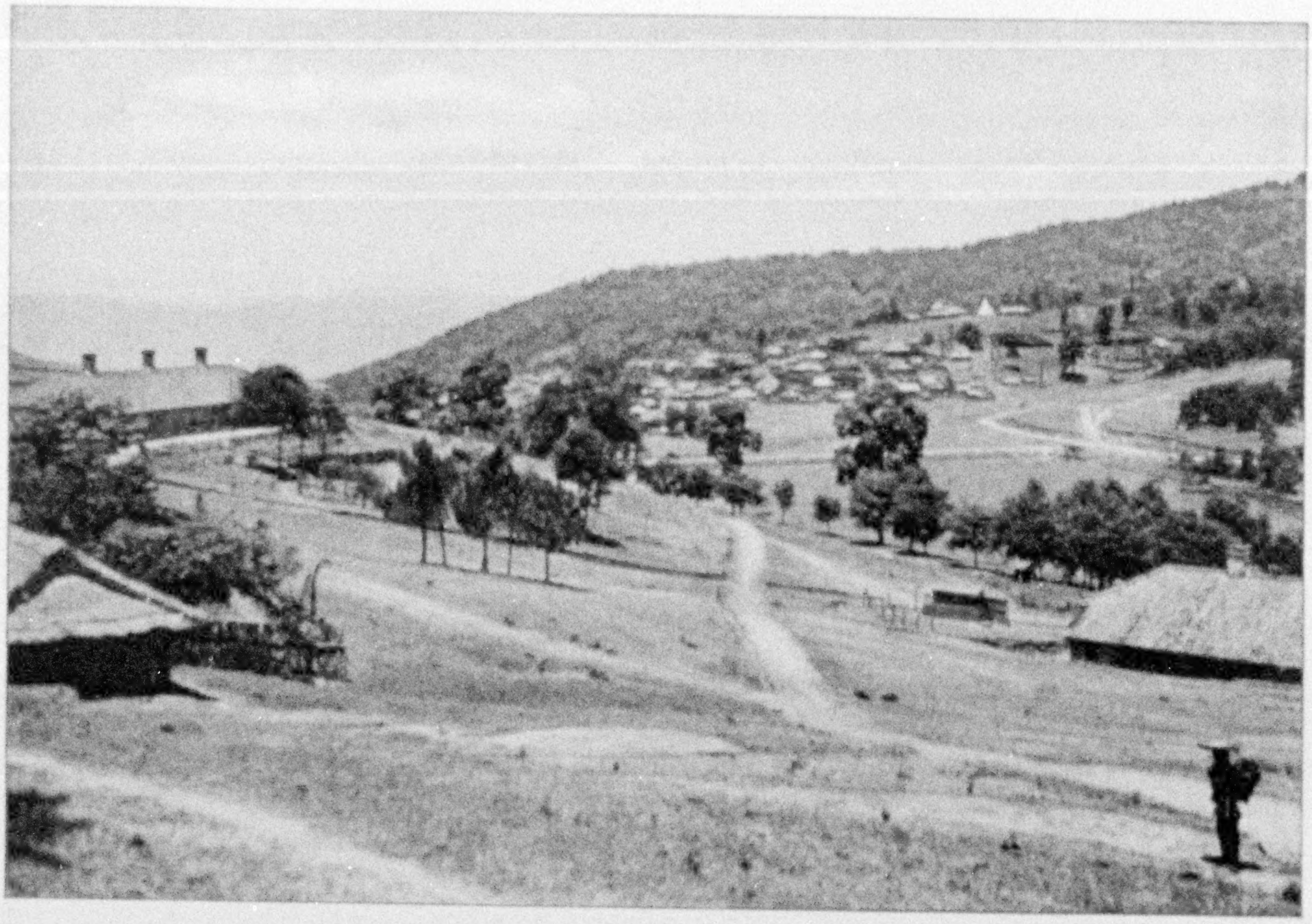
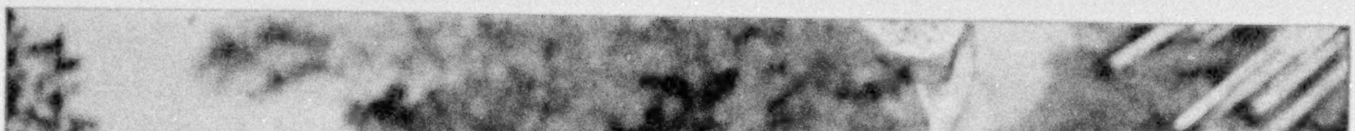
ALONG A KENG TUNG LANE SHE BEARS HER GIFT TO THE TEMPLE

The lacquer bowl of native workmanship which this Khun girl carries (see Color Plate III) contains an offering of food for the Buddhist priests, who have a strong following among her tribe.



GREAT BRITAIN MAINTAINS A MILITARY STATION ON LOI MWE

The cleared top of this mile-high mountain near the town of Keng Tung affords a cool cantonment site for a detachment of Gurkha riflemen. Beyond the artificial lake lies a Shan village.



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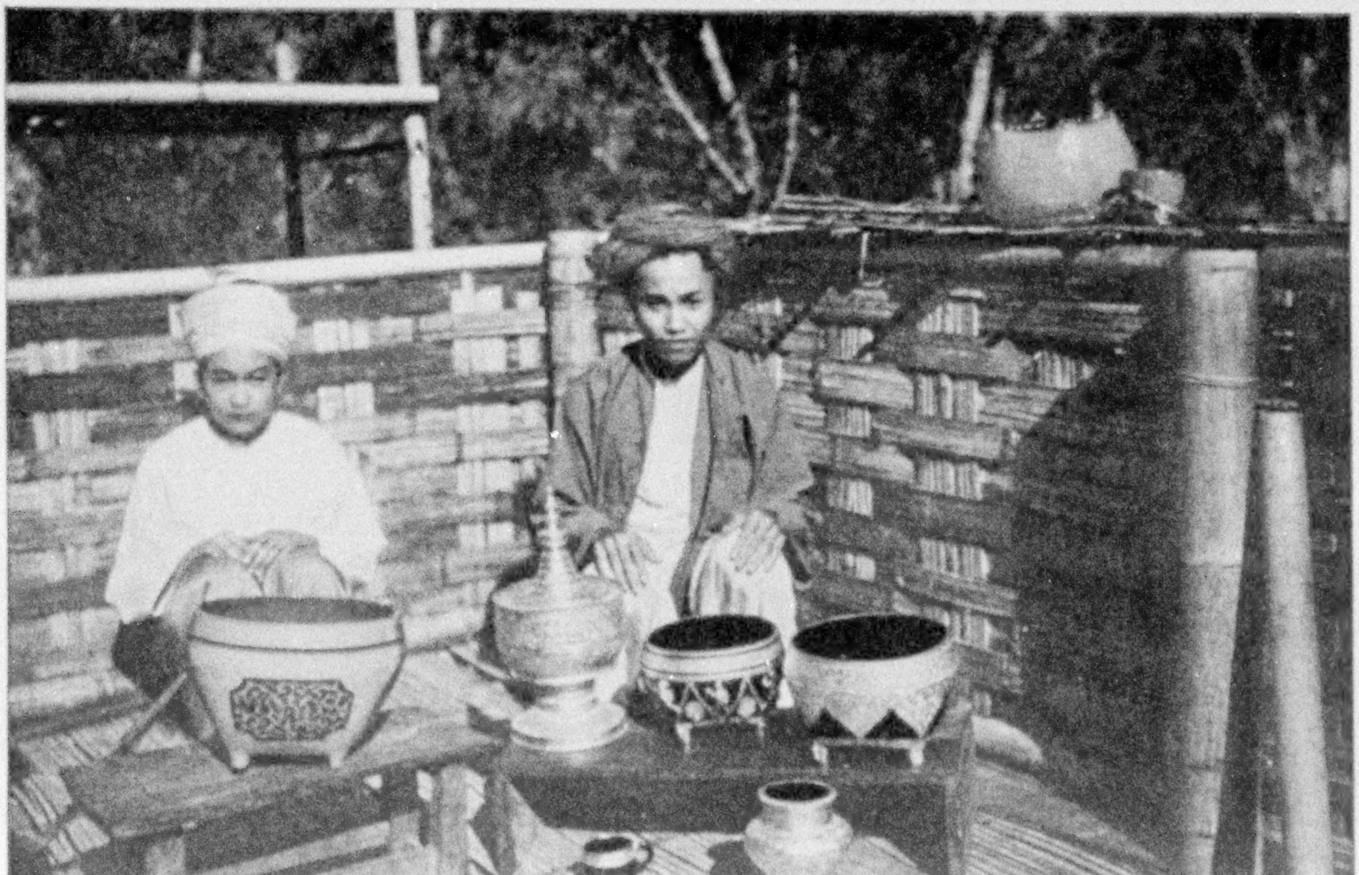
NOMADS OF THE TIMBERLAND, KAWS ENJOY A CAREFREE LIFE

Like their fellow hill people, these tribesmen are agricultural "birds of passage." They clear a forest tract, grow one or two crops on it, and then move on to virgin ground. The man on the left has a native-made gun, the other a crossbow. Both men and women are inveterate pipe smokers.

PIPES OFFER SOLACE TO KAW WOMEN WATER CARRIERS

These girls were on the way to a distant spring, with pack baskets full of gourd jugs slung on their backs by means of shoulder yokes and head cords.



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KHUN LACQUER WORKERS SELL EXQUISITE WARES IN KENG TUNG BAZAAR

Many of the pieces are decorated with delicately molded relief figures and intricate designs of striking originality, but the artists get very little for them. The price asked for a bowl like the center one on the lower bench is only three dollars in gold!

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SHAN FASHION DECREES GAY SKIRTS AND SUN SHADES FOR THE LADIES; FOR THE MEN—TATTOOING

To these girls of Keng Tung State their Burma-made red parasols are indispensable in rain or shine. The young dandy displays rather less than the average area of skin decoration. Usually heavier patterns are picked, particularly on the legs. Favorite subjects for the tattoo artists are birds, animals, and people. Designs resembling crossword puzzles and life-story pictographs also are used.

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STRIKING COSTUMES SET OFF KAW BEAUTY

This maiden is one of the most attractive of her village. The ornate headdress and kilt skirt are feminine styles peculiar to the tribe.

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NATIVE CROSSBOWS CAN KILL AT 80 YARDS

Tribal huntsmen are expert shots with these weapons. Considerable strength is required to cock them. Bamboo arrows, some tipped with poison, are used in hunting game.

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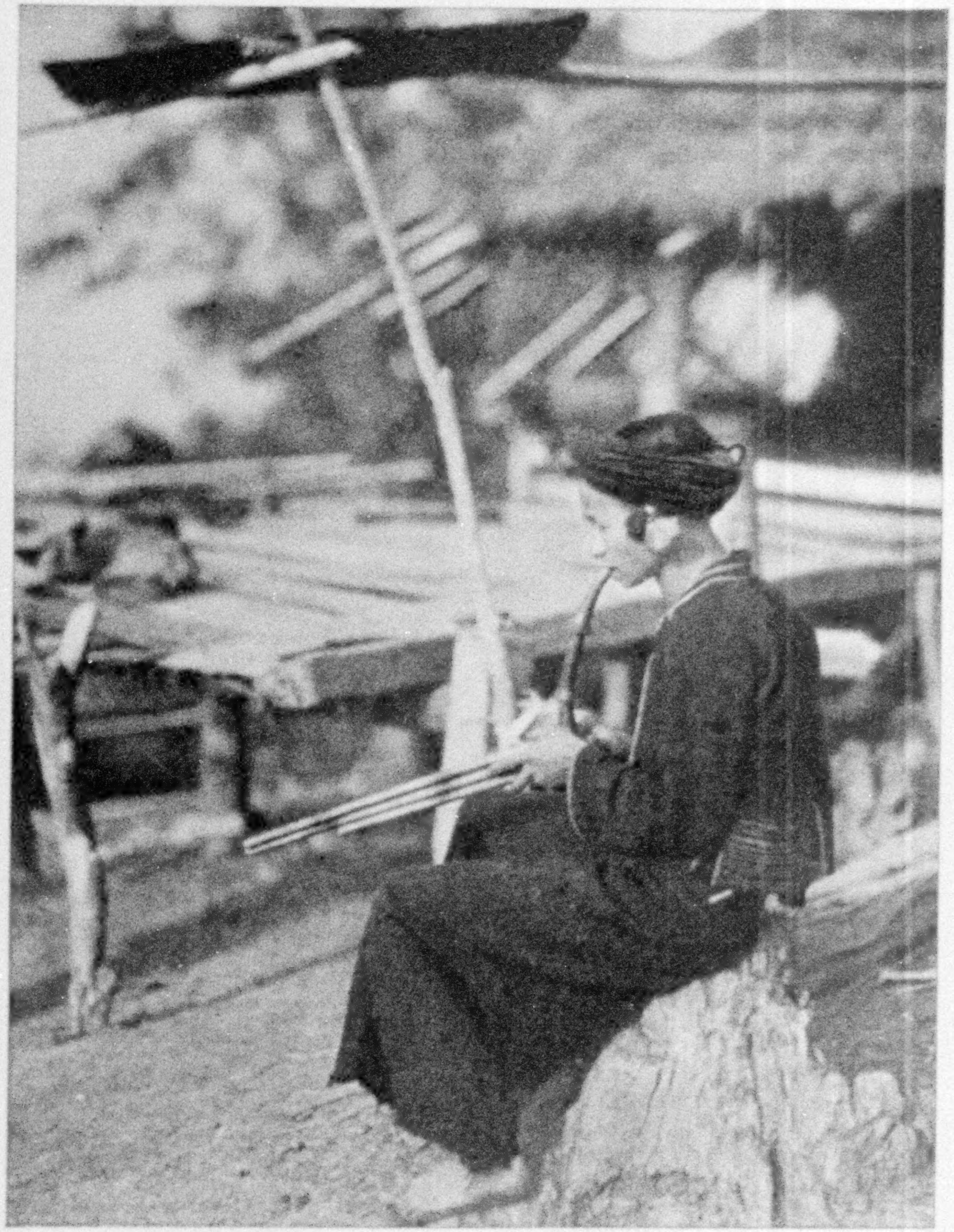
SIMPLICITY MARKS THE KHUN WOMAN'S ATTIRE

People of her tribe have achieved considerable importance in Keng Tung State, one of them being the *Sawbwe*, the native ruler to whom the British give almost complete authority.



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MUSIC DELIGHTS THE KAW SWAIN'S HEART

Played by a native musician, the *kan*, wondrously fashioned of gourds and bamboo pipes, produces eery flute notes of minor quality. It is made in different sizes by several tribes.

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FEMININE MODES DIFFER WIDELY AMONG THE SEVERAL TRIBES

In the Keng Tung bazaar on market days many styles of costumes are seen. The "boyish bobs" of these two Kang girls indicate that they are single. When they marry, they will let their hair grow and put on high turbans. The bands of black polished cane worn about the hips are characteristic. The woman at the right is a Lahu Na. She wears the long jacket and breast ornaments distinguishing people of her group from their cousins, the Lahu Shi.

WOMEN'S SKIRTS SUPPLY THE ONLY VIVID COLOR IN LAHU SHI COSTUMES

The men invariably wear dark blue or black gaberdines, and turbans for both sexes are somber. These folk and their relatives, the Lahu Na (see Color Plate VII), live in thatched bamboo houses raised above the ground on poles.

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MUSIC MAKES LIGHTER LOADS

Here a group of Lahu Shi tribespeople are toiling up from their hillside fields to the weird strains of the *kan* (see Color Plate VI). Head bands aid in keeping in place shoulder yokes which support the heavy baskets of produce.

mother for quite considerable distances. He remains at heel for four or five years, after which he is more or less able to look after himself. At twelve to fourteen years of age his training begins, but for the first few years of his working life he is used only as a "traveler" and he is asked to carry only light loads on the line of march. At eighteen he may be put on light timber work and he reaches his full strength at the age of twenty-five.

Elephants caught wild are generally taken in traps known as *keddahs*, which may be several acres in extent and capable of capturing a whole herd at a time. The keddah is formed of a strong stockade of tree trunks with a bottle-necked entrance, into which the victim is either driven or wanders of its own free will. Once in the keddah, there is no escape, and trained elephants are then used for securing with ropes the animals thus caught.

A full-grown elephant taken wild can be trained in two months, but it is not wise to work him for at least a year. The strain of being captured tells on him to such an extent that it is necessary to allow him liberal rest before putting him into full work.

As a rule, elephants are very gentle. They seldom attack human beings unprovoked, but occasionally they are capable of waging bitter warfare among themselves.

The Burman riders have it that the elephant's first point of attack is his adversary's tail, and for that reason they look with disfavor on those animals which have had part of the tail wrenched off. Whatever the truth of this may be, it is quite certain that the tuskless sometimes defeats the tusker by obtaining a grip of the latter's tusks with his trunk—under one and over the other—and with the leverage thus obtained succeeds in breaking a tusk or at least in throwing his enemy.

The tuskless males are frequently the heavier animals and are capable of taking command of a herd.

MYSTERIOUS "MUST" ATTACKS MALES

There is no need to go into the question of *must*, that curious temporary insanity which, at almost regularly stated seasons, attacks males. In my opinion, it is not, as some people believe, a sex state. The cause is hard to determine, but it may be an overcharging of certain glands which have their exits in the face of the animal.

It is a simple matter to discover when an elephant is likely to become affected in this way, and to ward off the condition by steady work and the use of sedative drugs. The captive elephant is subject to such attacks during his period of rest in the hot weather; when he is on full work, he is generally immune.

THE "ROGUE" MUST BE DESTROYED

One frequently hears of "rogue" elephants, elephants which attack at sight anything in view. These generally are either wild males suffering from must, or animals that are suffering from festering gangrened wounds. There is no way out with a rogue but to shoot him at the first possible chance. On examining the corpse one usually finds that toothache in a tusk has been the cause of his trouble.

The elephant, despite his size, is easily frightened, and a white fox terrier is often enough to make him exhibit every sign of embarrassed nervousness to an extent that is almost ludicrous. He rubs one hind foot against the other in the manner of a naughty little boy, trumpeting piteously for somebody to take the little wretch away.

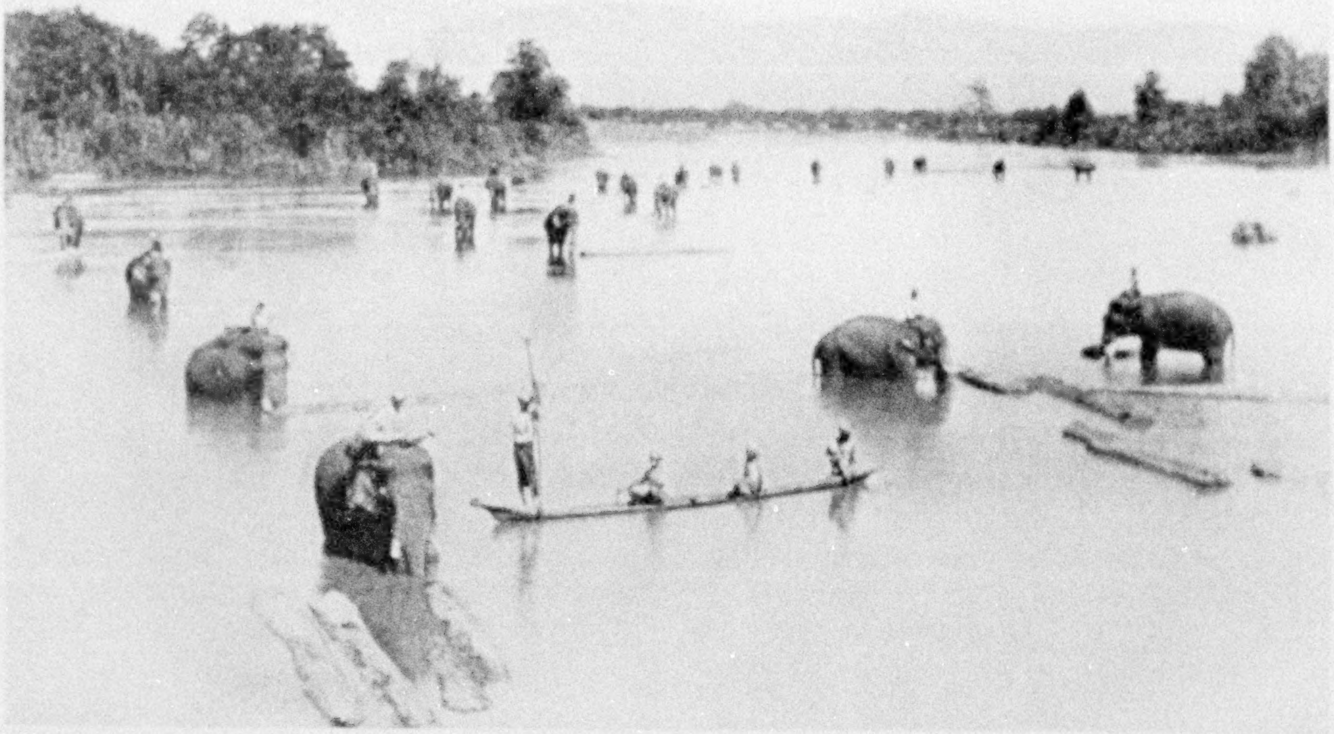
There are few people who have not heard of some instance of the sagacity of elephants.

It is almost uncanny to notice the skill with which an elephant sets about breaking up a jam of logs in a creek bed. Pushing here and pulling there, he seems to be able to sense which is the key log and he stands clear when the pile starts tottering, ready to fall with a crash.

That this sagacity is inherent and not a matter of training is apparent to anyone who has seen an elephant about to cross boggy ground. With care he tries it with his weight gently applied, then he tears down branches with his trunk to make a firmer footing.

If an elephant does get into soft ground too deep for him, he grabs everything within reach to thrust under his feet to get a foothold. He may even sweep the rider off his back and trample him in his efforts.

There is usually good sense behind the elephant's actions. In dragging a heavy



Photograph by A. W. Smith

AN "OUTING" PARTY AT WORK

The rains are nearly over and a party of 20 or 30 elephants has been sent to work down the river to push the timber into deep water before the floods subside. The dugout canoe is being used to locate logs. Its narrow beam makes it difficult for a European to sit balanced, but Burmans are expert in the use of these craft.

log he often curls his trunk up a little and thrusts it out ahead rigidly, to act as a buffer and save him from a fall should the drag chain break. No natural experience could have taught him this.

THE ELEPHANT AS A SUPERMACHINE

Efforts have been made to make machinery do elephants' work in the forest, but without success. Machines cannot reason. The jungle man does not understand them. Machines require spare parts, gas, oil, and an expensive workshop organization to keep them in use. An elephant's first cost is less than that of a machine; his working life is fifty years; he does things that no machine ever invented could do. For the present, at least, the elephant has no equal.

Work in the forests is hard, the life lonely, but it has its compensations. Sometimes I think I should like to go back to it—to see the elephants coming into camp in the chill of a winter dawn, to see the mist smoking off the river, and to hear the bark of the deer deep in the forest.

It is a form of homesickness; but to rid myself of it I have only to think of July in the jungle—of weeping gray skies and muggy hot weather, of the discomforts of a dripping tent and damp blankets, of fever and leeches and ticks. It is an unfailing cure, and I am glad I am not earning my living in that way any more.

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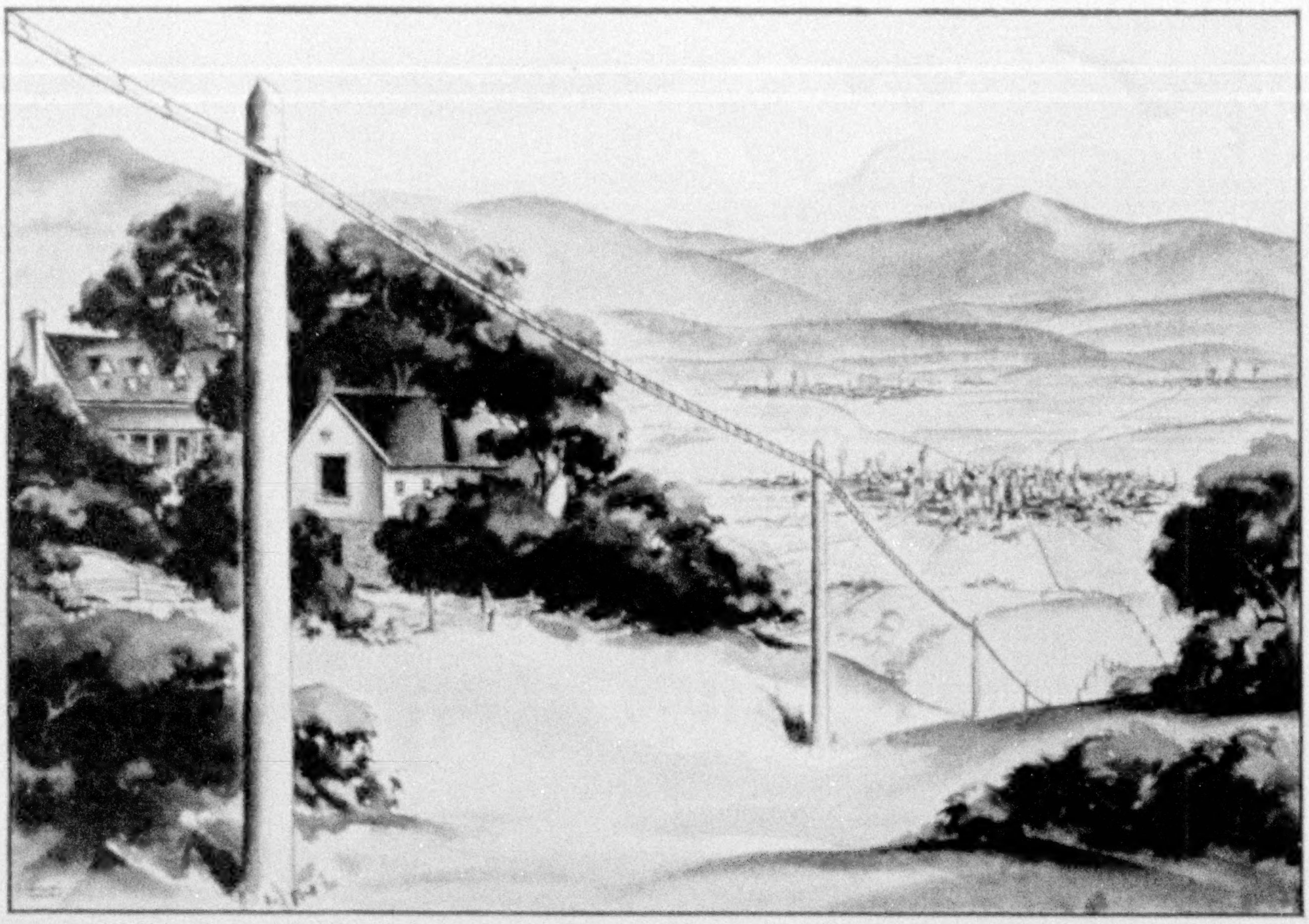

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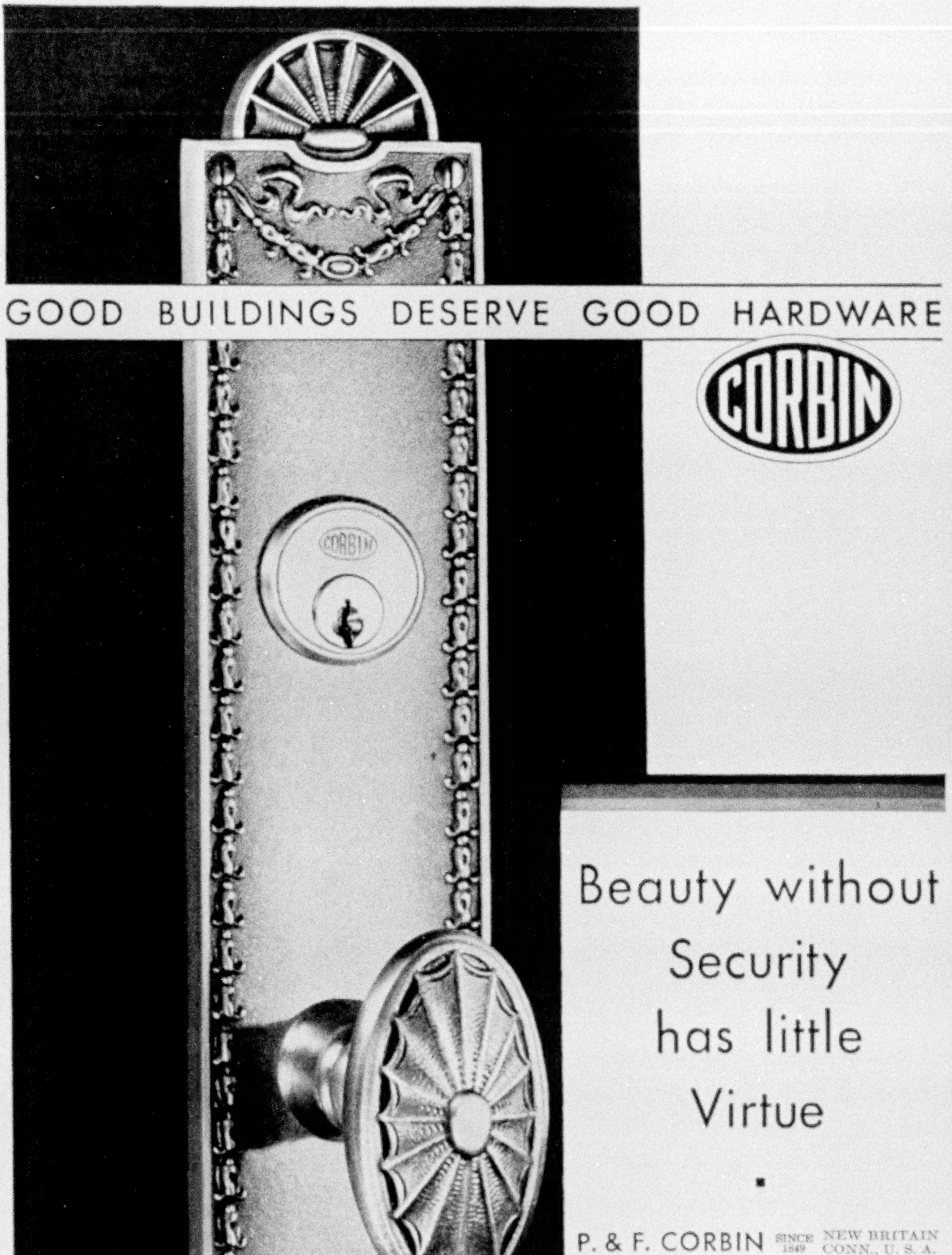

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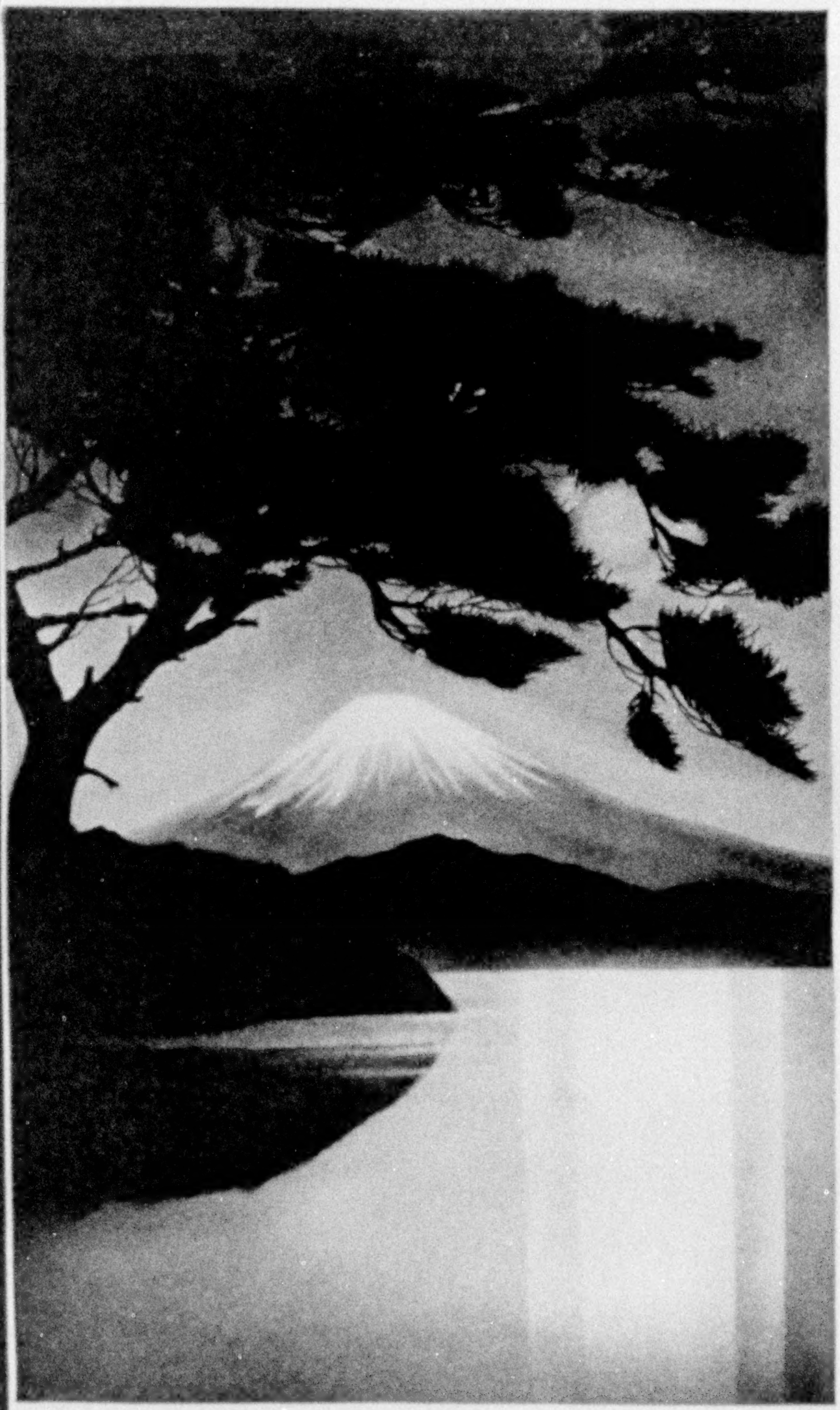

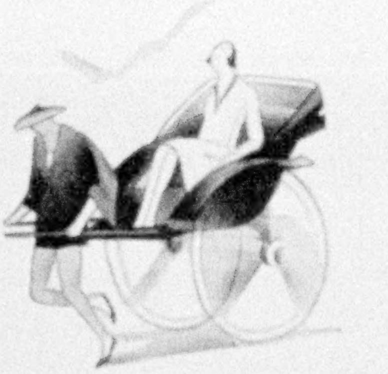

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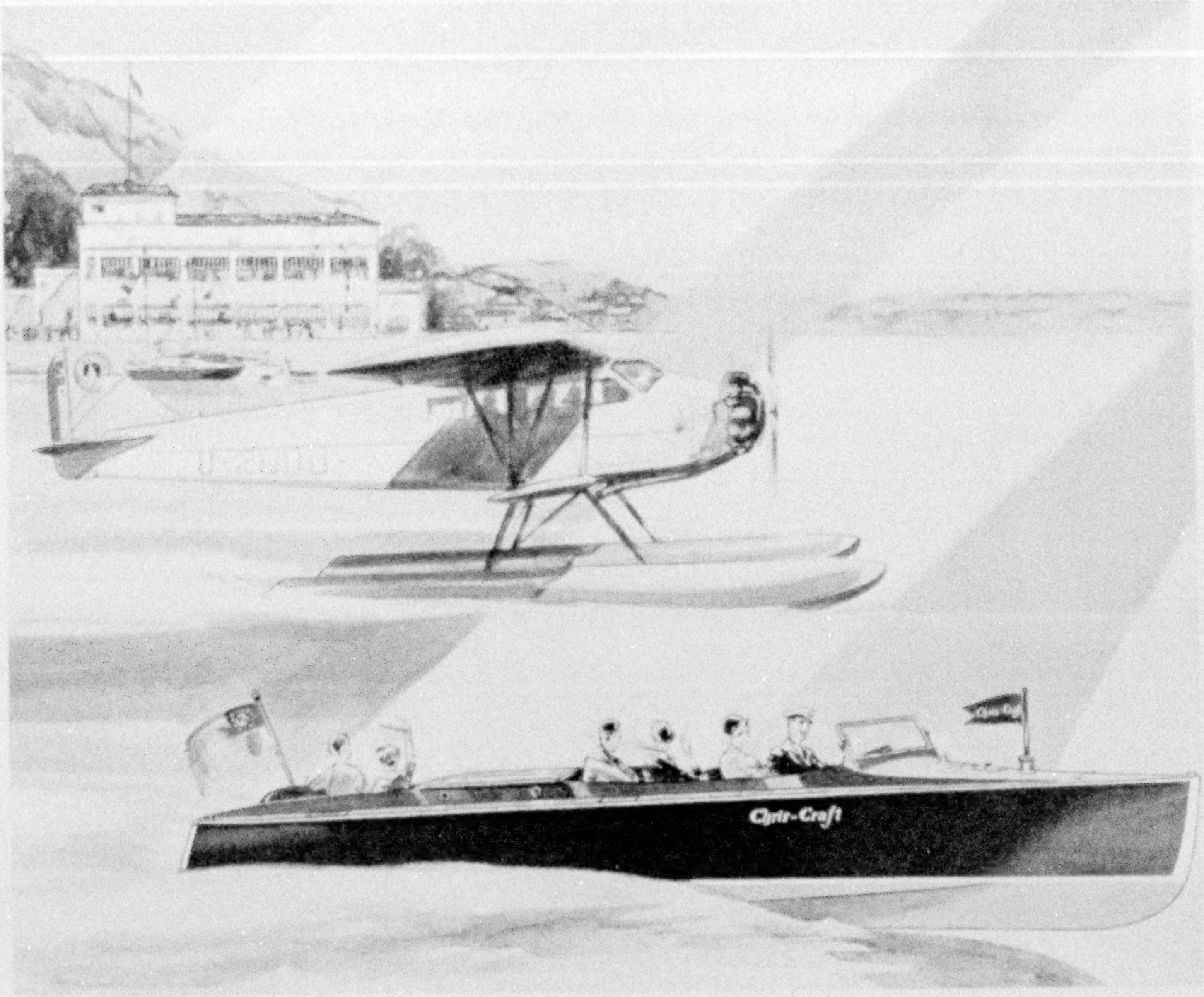

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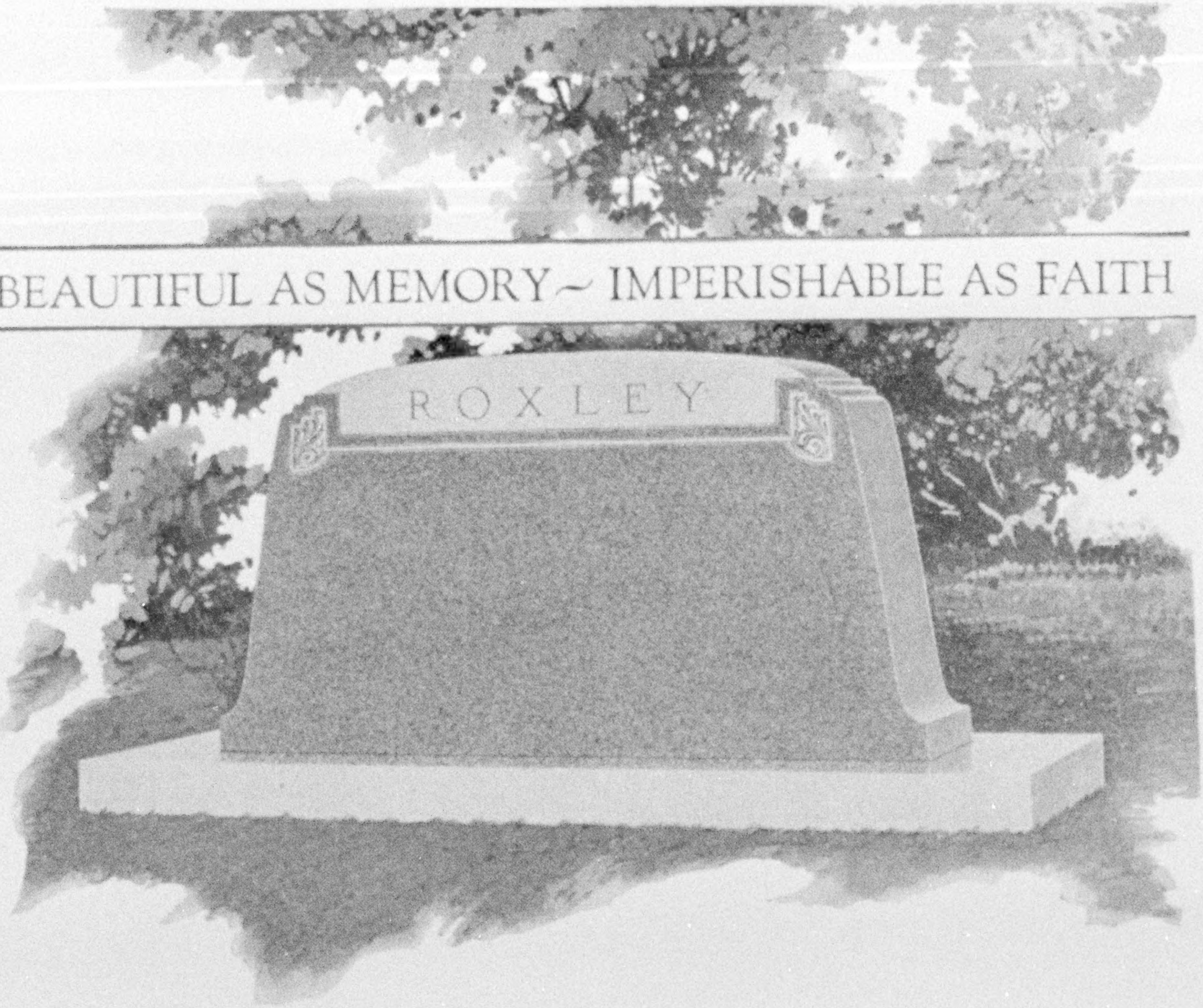

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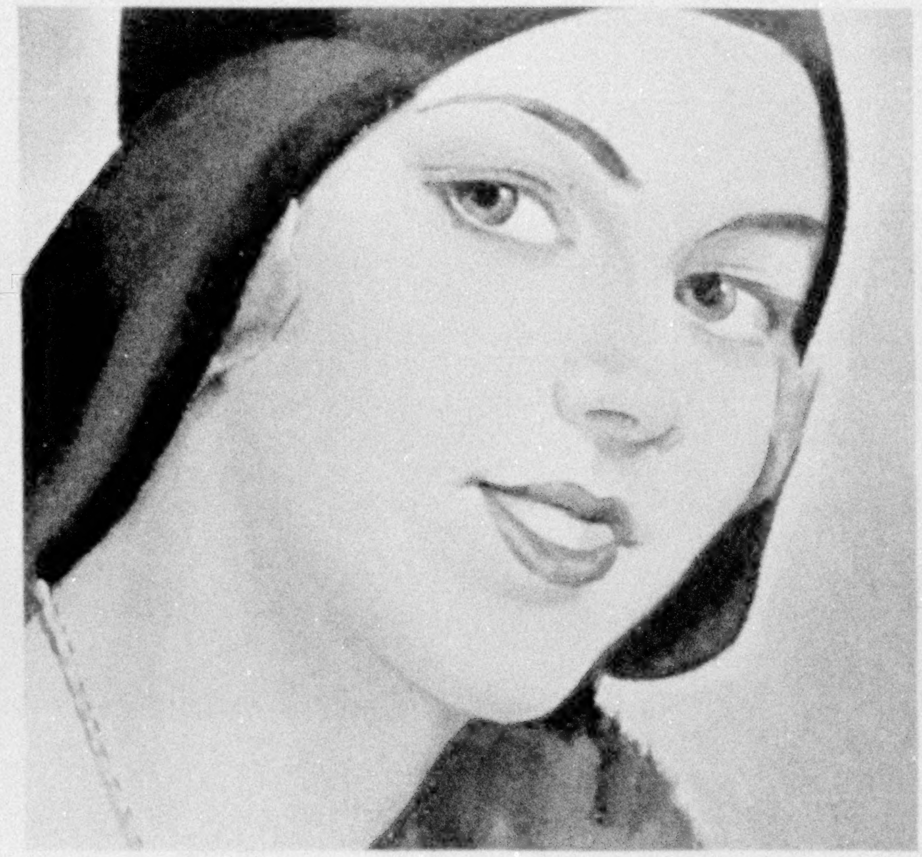

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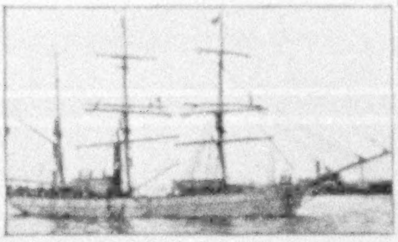

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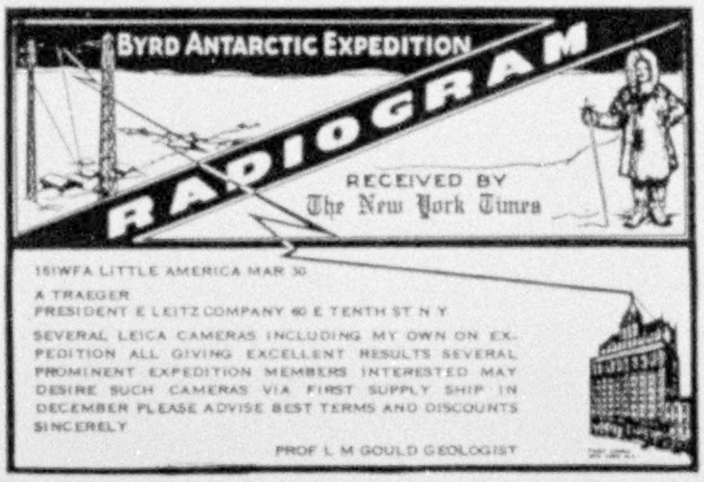

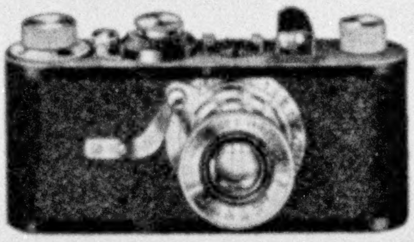

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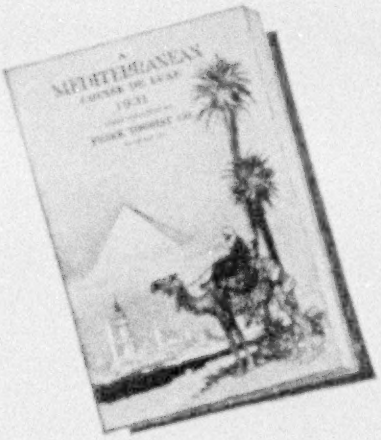

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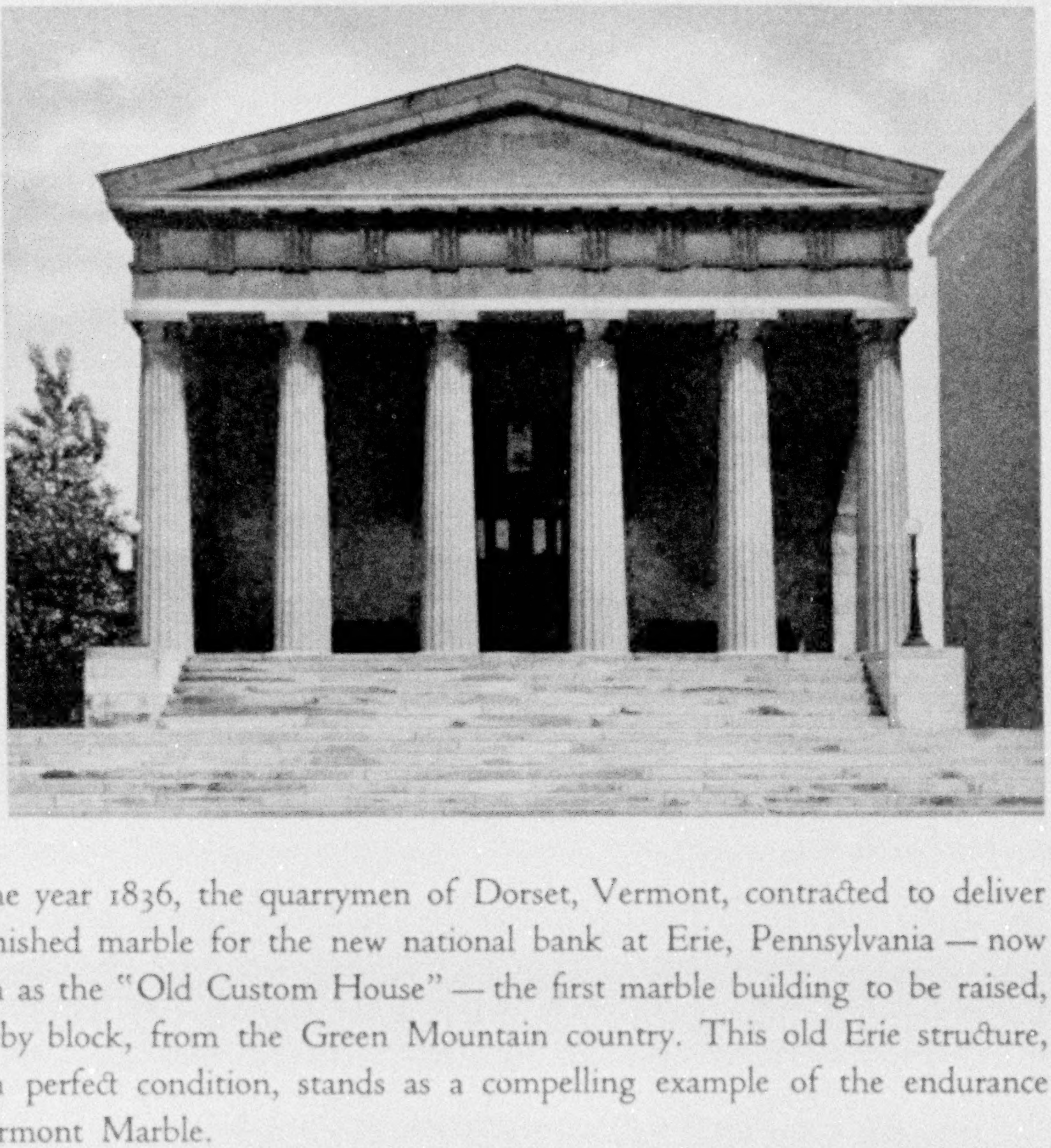

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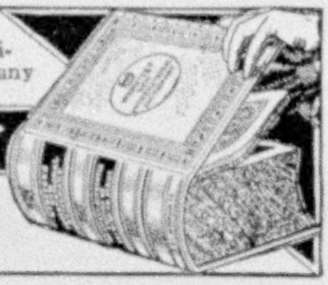

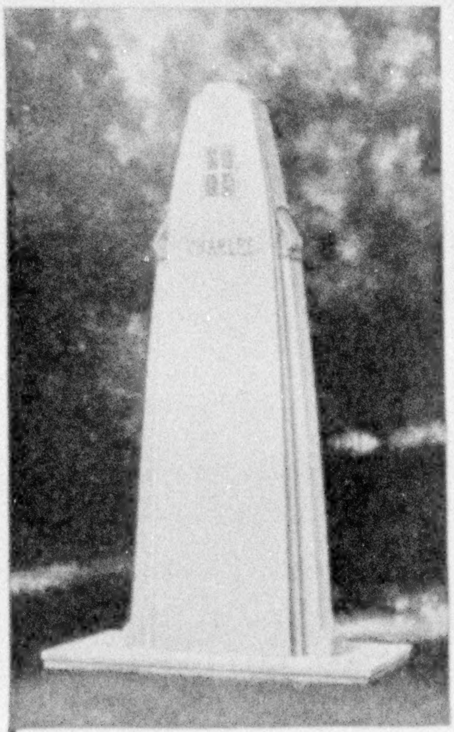

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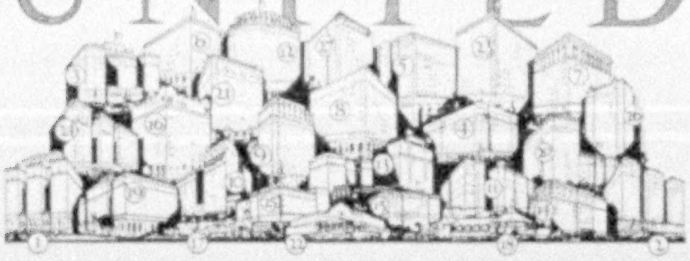

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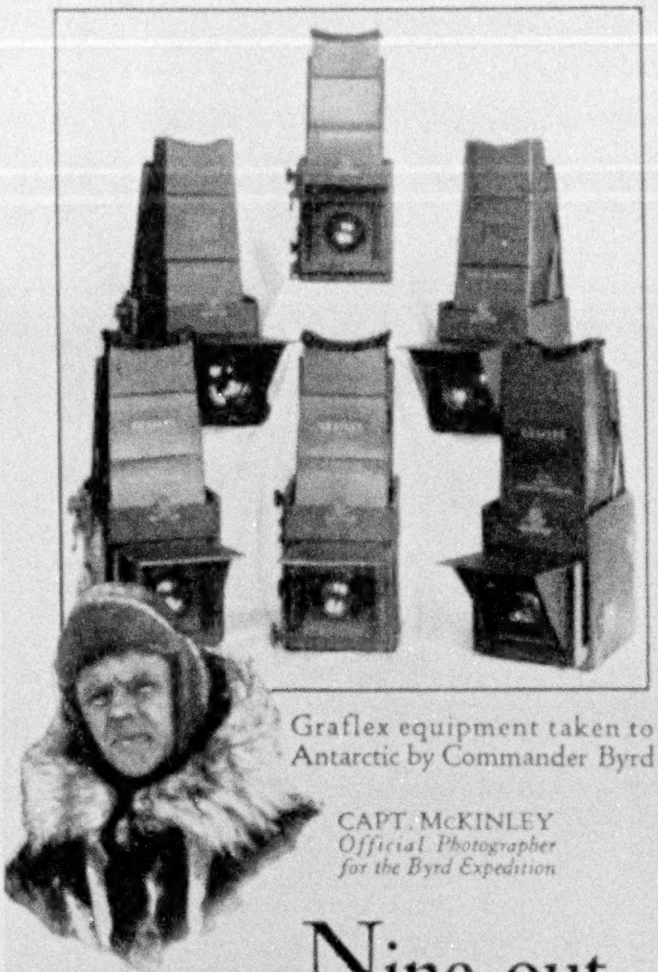

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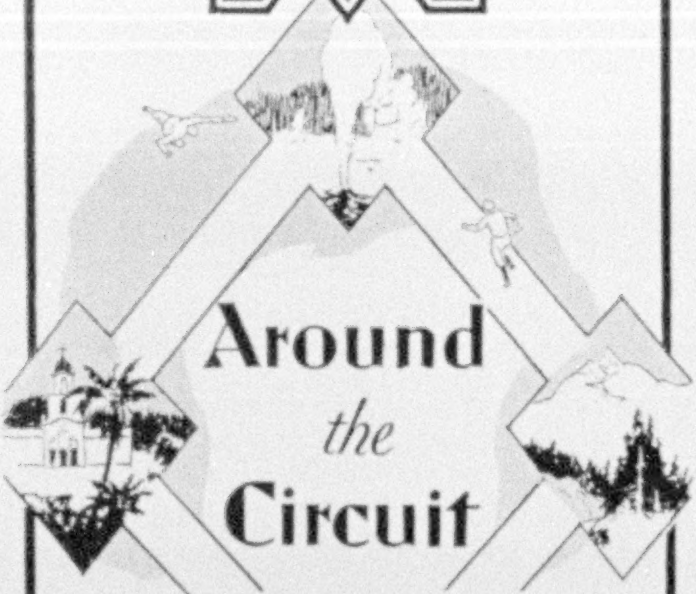

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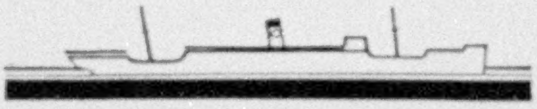

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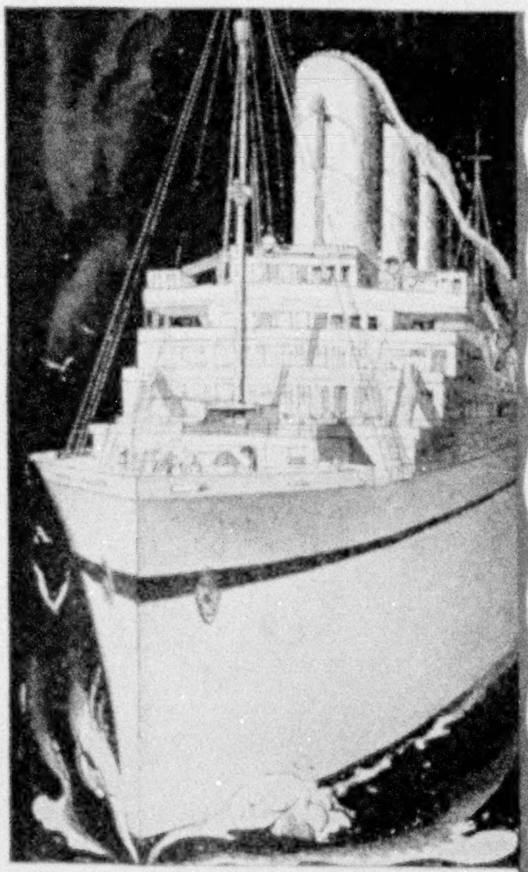

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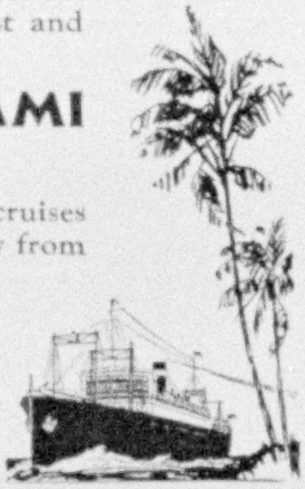

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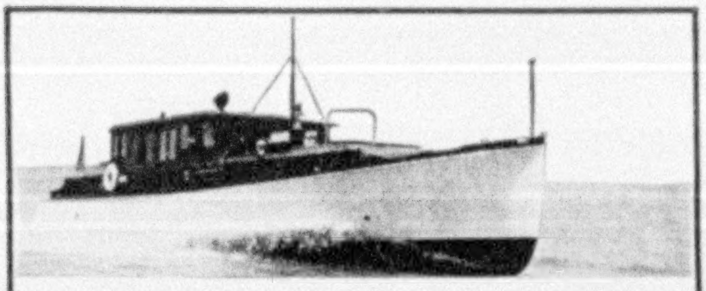

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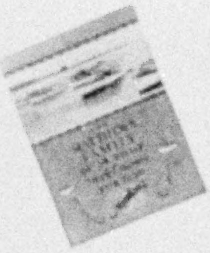

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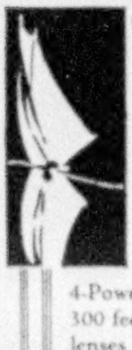

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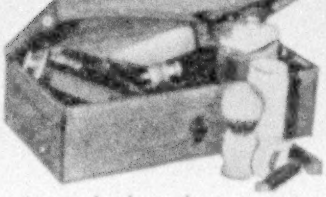

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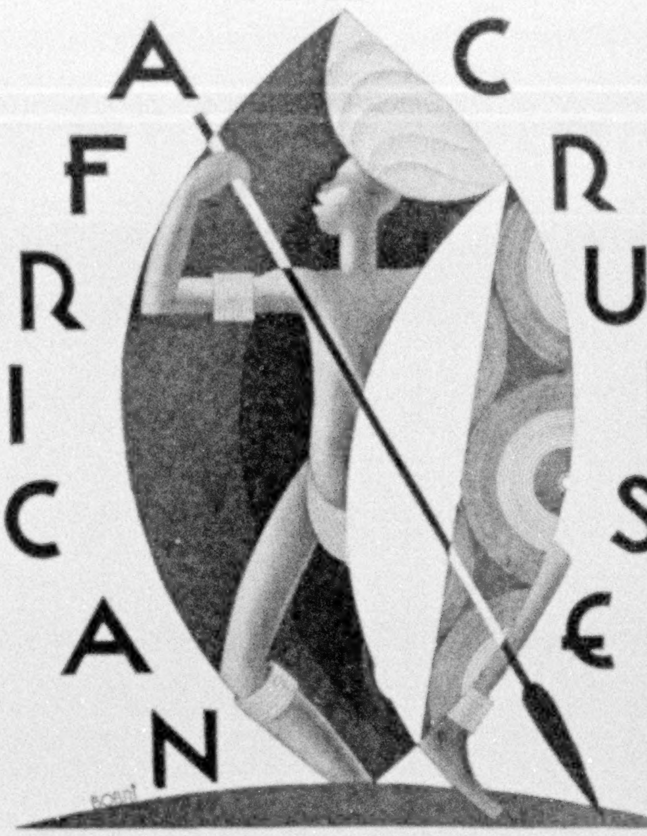

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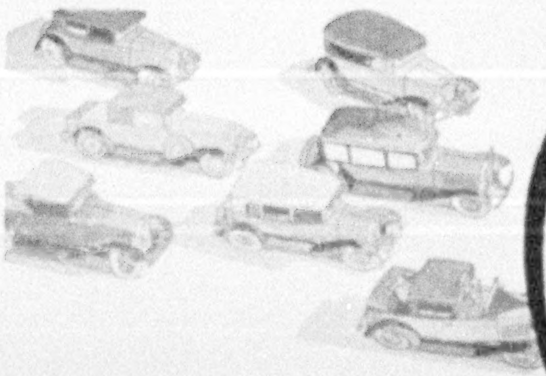

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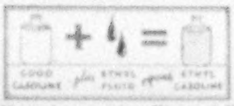

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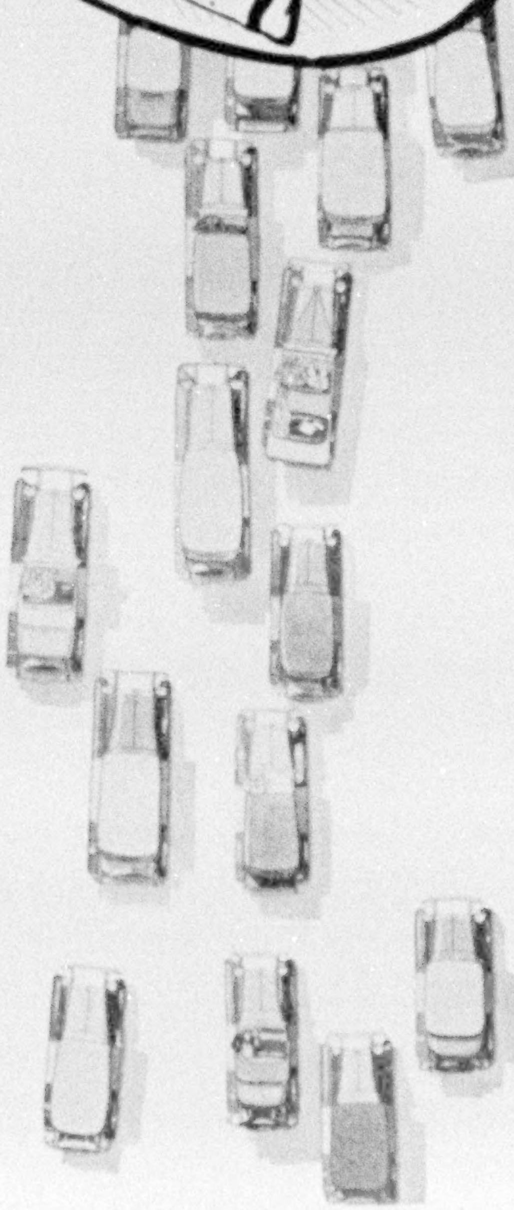

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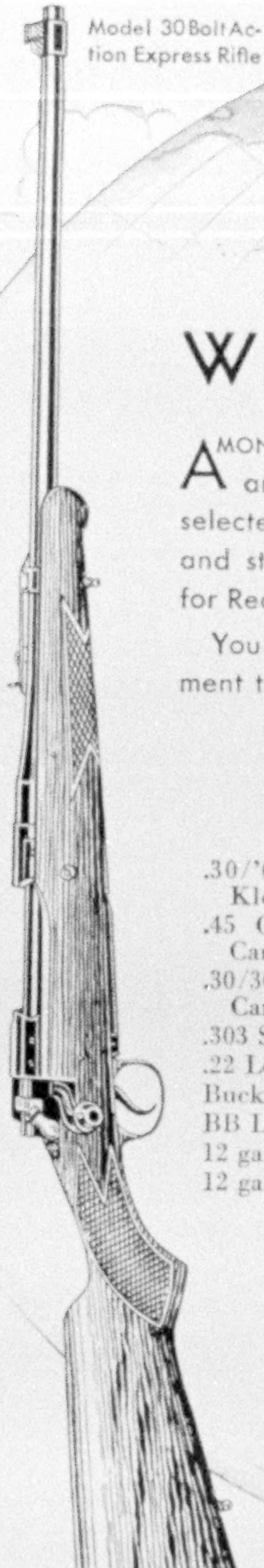

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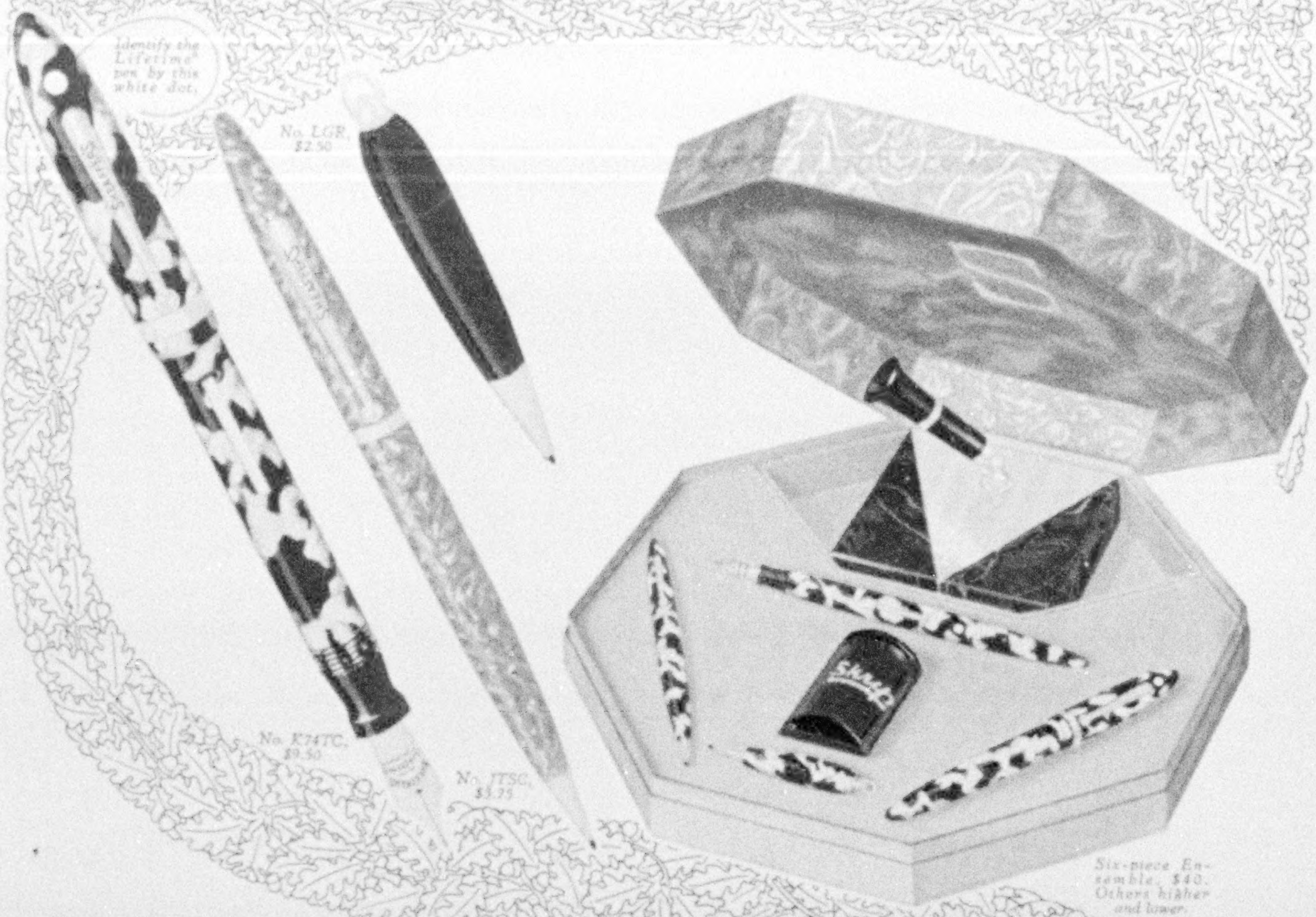

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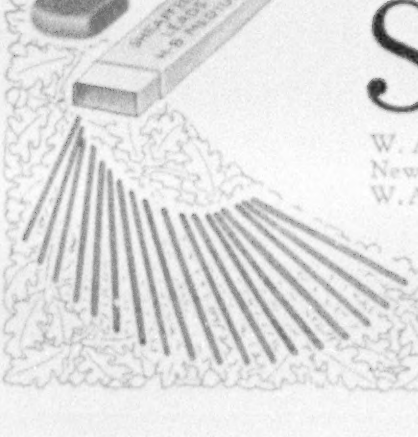

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